IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

GTECH CORPORATION,

Plaintiff,

v.

SCIENTIFIC GAMES INTERNATIONAL, INC., SCIENTIFIC GAMES HOLDINGS CORPORATION, SCIENTIFIC GAMES FINANCE CORPORATION, and SCIENTIFIC GAMES CORPORATION,

Defendants.

C.A. No. 04-138-JJF

REDACTED VERSION

APPENDIX OF EXHIBITS IN SUPPORT OF SCIENTIFIC GAMES' ANSWERING CLAIM CONSTRUCTION BRIEF

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Exhibit R

Redacted

Exhibit S

United States Patent [19]

Herring

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[45] **Jun. 12, 1979**

[54] **TICKET VENDING HEAD**

[75] Inventor: **Lloyd D. Herring**, Jenison, Mich.

[73] Assignee: **Rowe International, Inc.**, Whippany, N.J.

[21] Appl. No.: **819,251**

[22] Filed: **Jul. 27, 1977**

[51] **Int. Cl.**[2] **B65H 35/06**

[52] **U.S. Cl.** **83/165**; 83/176; 83/209

[58] **Field of Search** ..... 83/380, 212, 243, 298, 83/176, 165; 312/39; 194/10, DIG. 8; 221/2, 13; 225/103, 104, 105, 32; 270/67

[56] **References Cited**

U.S. PATENT DOCUMENTS

2,973,707	3/1961	Crivelli	194/10 X
3,256,760	6/1966	Vaero	83/176
3,894,669	7/1975	Wescoat	83/212 X
3,978,958	9/1976	Zandstra	221/22 X

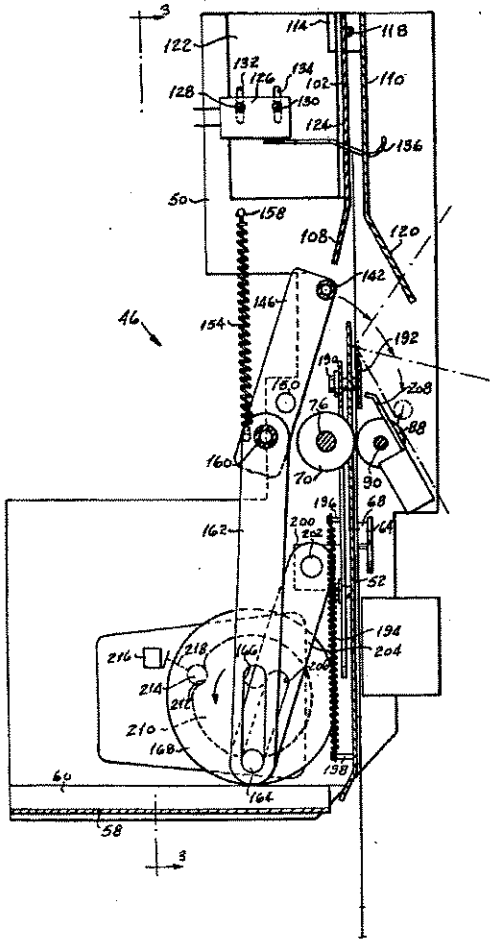
Primary Examiner—Stanley H. Tollberg

Attorney, Agent, or Firm—Shenier & O'Connor

[57] **ABSTRACT**

A ticket dispensing head for delivering individual tickets from a string of tickets connected by laterally extending lines of ticket material weakness in which tickets are advanced along a generally linear path past a breaker blade toward a limit switch adjustably positioned in the path of movement of the tickets beyond the breaker blade by a distance slightly greater than the length of a ticket with actuation of the switch interrupting the ticket drive to position the line of weakness connecting the leading ticket to the next ticket just beyond the blade breaker edge to permit a folder to fold the ticket along the so positioned line over the blade breaker edge for severing of the first ticket precisely along said positioned line upon subsequent actuation of the breaker blade to move along a path generally parallel to the ticket path. The position of the switch is adjusted to accommodate tickets of different size.

19 Claims, 5 Drawing Figures



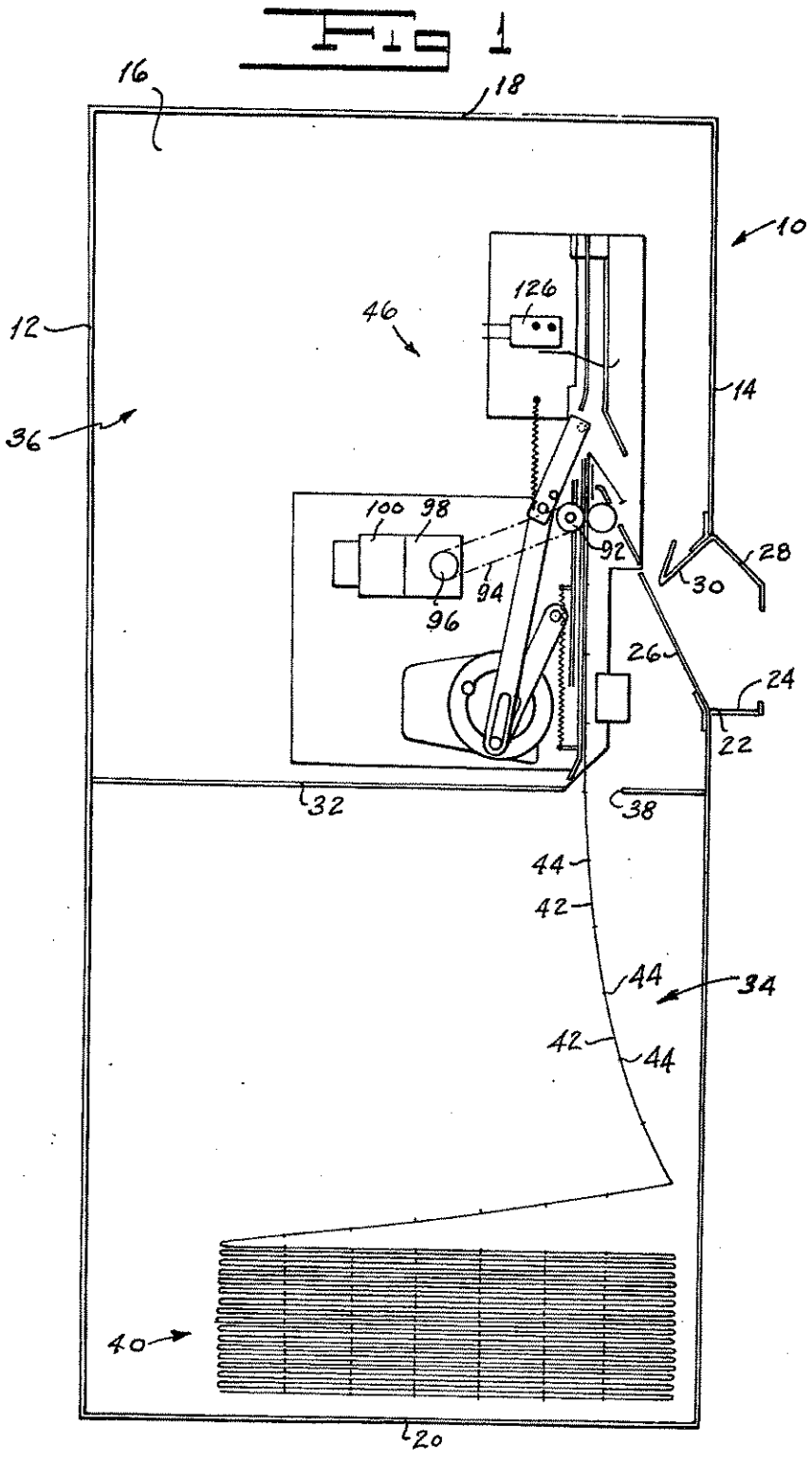

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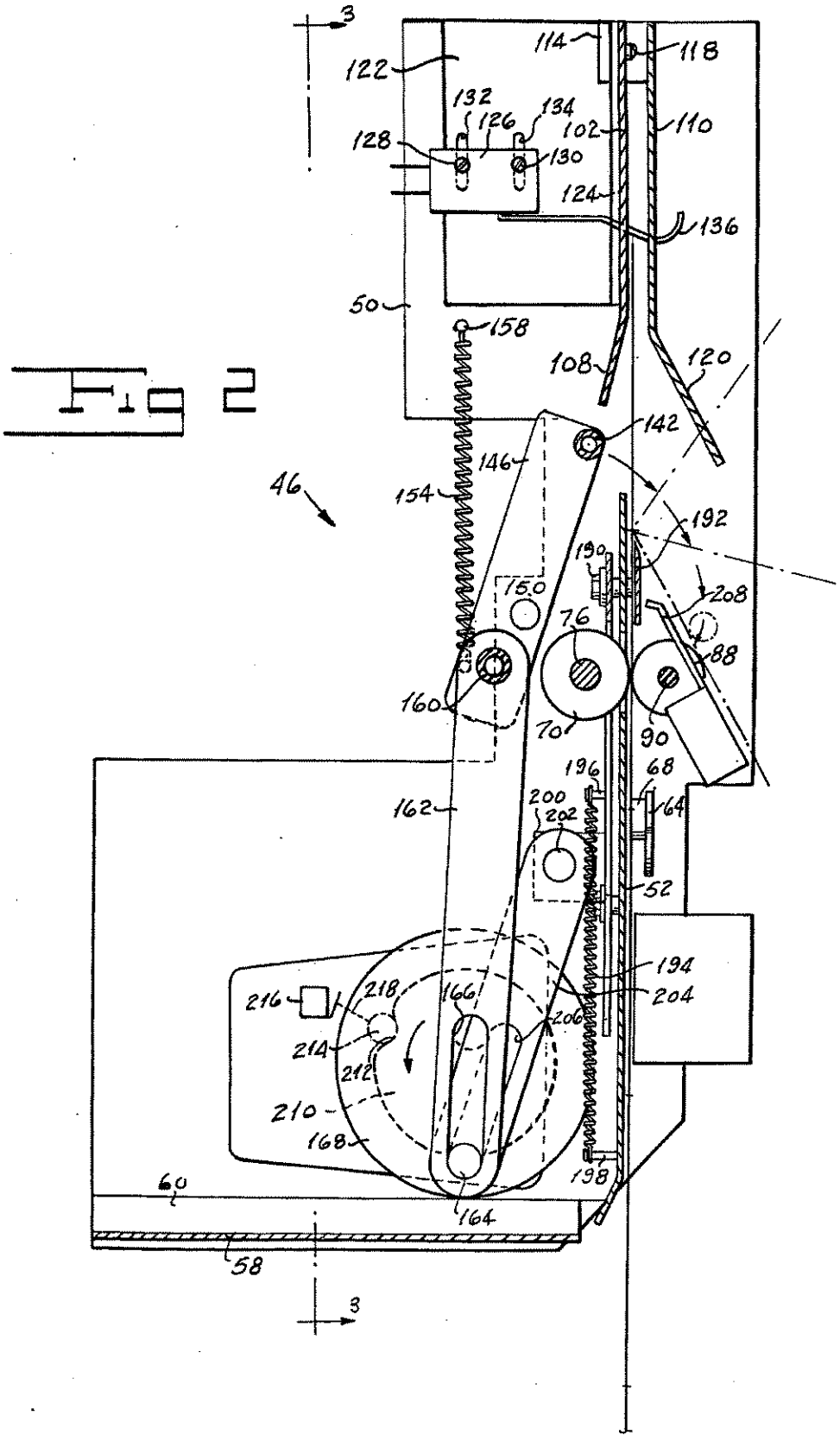
Fig 2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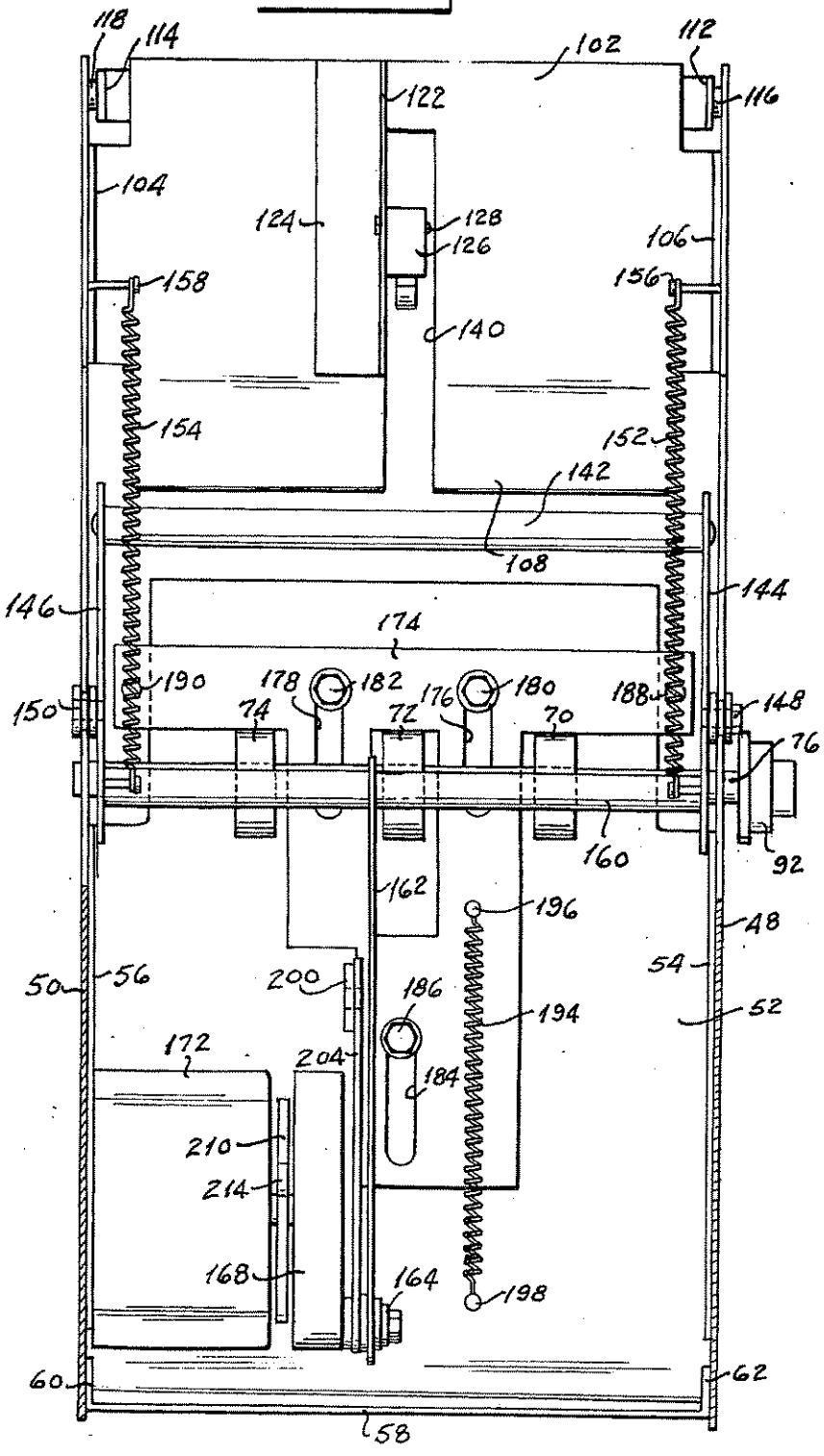
3

Fig 3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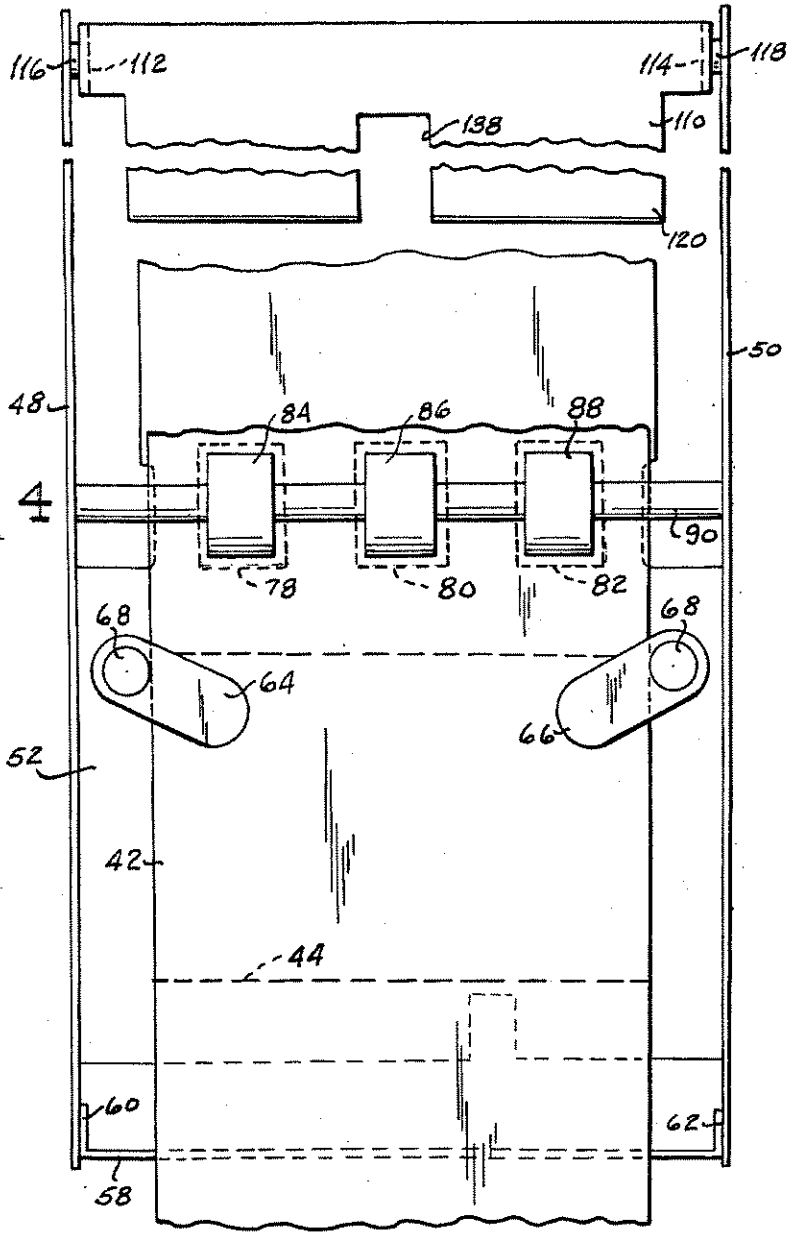
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Fig 4

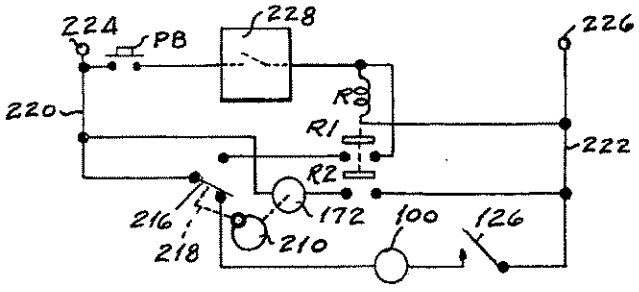
224
PB
228
226
220
R3
R1
222
R2
216
218
172
210
100
126

Fig 5

TICKET VENDING HEAD

BACKGROUND OF THE INVENTION

Various forms of apparatus are known in the prior art for advancing a string of tickets from a supply and for severing individual tickets and delivering them to a customer. Usually, such tickets are separated by a laterally extending line of weakness. One form of such apparatus incorporates a sprocket wheel having teeth adapted to engage notches or holes along the edge of the tickets. The sprocket is driven until the line of weakness connecting the leading ticket to the remaining tickets in the string is positioned in the path of movement of a cutter or breaker blade which is driven to sever the leading ticket from the remaining tickets in the string.

The ticket dispensing apparatus described above incorporates a number of disadvantages. First, the size of the tickets being dispensed cannot readily be changed unless the pitch or distance between successive feeding notches or holes for the new size ticket is an integral multiple of the original distance between feeding notches or holes. If such is not the case, then the feeding wheel must be changed. Moreover, ticket feeding apparatus of this type requires either that the string of tickets originally be formed with advancing perforations or holes or that the string be so perforated prior to use on the apparatus.

Attempts have been made in the prior art to overcome the difficulties of ticket delivery apparatus of the type described hereinabove. One attempt to overcome these difficulties is the use of friction rollers as a ticket advancing means in combination with means for sensing the leading edge of the ticket to stop the advance of the ticket with the line of weakness of material connecting the leading ticket to the remaining tickets in the string positioned in the path of a breaker blade or cutter which moves in a direction generally perpendicular to the direction of movement of the string of tickets. While such an arrangement permits of the ready adjustment of the apparatus to accommodate tickets of different sizes, which different sizes may vary only slightly from each other, it incorporates another defect. That is to say, the breaker blade must be carefully adjusted so as to strike the line of weakness or perforations. If for any reason, at the time of the separating operation, the line of weakness is not precisely positioned with reference to the edge of the breaker blade, the leading ticket will not be cut precisely along this line. Thus, on the next operation of the machine, the edge which is sensed is not truly the leading edge of the next ticket so that the error becomes cumulative.

One example of the first type of ticket delivery apparatus described hereinabove is illustrated in Verduin et al, U.S. Pat. No. 3,770,089. Riddle et al, U.S. Pat. No. 3,621,964, and Zandstra U.S. Pat. No. 3,978,958 are illustrative of the second form of ticket delivery apparatus described hereinabove.

I have invented a ticket vending head which overcomes the disadvantages of ticket dispensing apparatus of the prior art discussed hereinabove. My ticket vending head requires no change in parts to accommodate a change in ticket size. My vending head accommodates a wide range of ticket sizes with very small differences in ticket sizes. It does not require the provision of ticket advancing notches or holes in the tickets. My ticket vending head does not require critical relative positioning of parts. It will accommodate a considerable error in line of weakness to line of weakness spacing at the ends of a ticket. My ticket dispensing head avoids the accumulation of errors which may result in the use of apparatus of the prior art.

SUMMARY OF THE INVENTION

One object of my invention is to provide a ticket vending head which will readily accommodate a wide range of ticket sizes without requiring substitution of parts.

Another object of my invention is to provide a ticket vending head which will easily accommodate relatively small changes in ticket size without substitution of parts.

A further object of my invention is to provide a ticket vending head which does not require the provision of ticket advancing notches or holes in the tickets.

Still another object of my invention is to provide a vending head which does not require critical relative positioning of parts.

Yet another object of my invention is to provide a ticket vending head which will accommodate considerable error in line of weakness to line of weakness spacing along the length of a string of tickets.

A still further object of my invention is to provide a ticket vending head which will not accumulate errors in the manner of certain ticket delivery apparatus of the prior art.

Other and further objects of my invention will appear from the following description.

In general, my invention contemplates the provision of a ticket vending head in which a drive means advances a string of tickets separated by transversely extending lines of weakness along a generally linear path toward a sensing means responsive to the leading edge of the string to interrupt the drive means with the line of weakness separating the leading ticket from the next ticket in the string located slightly beyond the breaking edge of a breaker blade mounted for movement along a path generally parallel to the path of movement of the ticket path to permit a folding member to fold the leading ticket around the so positioned line of weakness over the blade breaker edge so that the positioned line of weakness is in the path of movement of the blade and the leading ticket will accurately be severed upon subsequent movement of the blade. The leading edge sensing element may be adjusted to accommodate tickets of varying sizes.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings which form a part of the instant specification and which are to be read in conjunction therewith and in which like reference numerals are used to indicate like parts in the various views:

FIG. 1 is a partially schematic side elevation of a ticket merchandising machine incorporating my ticket vending head with parts removed.

FIG. 2 is a vertical section of my ticket vending head incorporated in the machine illustrated in FIG. 1.

FIG. 3 is a rear elevation of my ticket vending head.

FIG. 4 is a front elevation of my ticket vending head with parts removed.

FIG. 5 is a schematic view of one form of electrical circuit which may be employed to control the operation of my ticket vending head.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. 1 of the drawings, a ticket vending machine with which my ticket vending head might be used includes a cabinet, indicated generally by the reference character 10, having a back 12, a front 14, sides 16, one of which appears in FIG. 1, a top 18 and a bottom 20. The front 14 is formed with a delivery opening 22. A first unitary member mounted along the lower edge of the opening 22 forms a delivery tray 24 and a guide 26 for directing a dispensed ticket into the tray 24. A second unitary member mounted so as to extend along the upper edge of opening 22 forms a shield 28 for the tray as well as a baffle 30 which is intended to prevent access to the interior of the cabinet 10 through the opening 22.

A horizontally extending partition 32 within the cabinet 10 divides the cabinet into a ticket supply storage area, indicated generally by the reference character 34, and a delivery head housing, indicated generally by the reference character 36. An opening 38 in the partition 32 permits a string of tickets 42 from a supply of tickets, indicated generally by the reference character 40, to move upwardly from the supply to the dispensing head, indicated generally by the reference character 46. The tickets 42 with which my head is intended to be used are connected by lines 44 of weakened material indicated schematically in FIG. 1 by dashes extending across the string of tickets. The lines 44 of weakened material are such that, in response to a force exerted against a ticket, the string will fold along a line 44. Moreover, in the usual case, tension applied to the string will cause it to part along one of the lines 44. Lines 44 may be provided by any suitable means. That is, they may be shallow cuts or lines of perforations, or the like. In the particular supply arrangement illustrated in FIG. 1, the tickets are in the form of a fan-folded supply 40. It will readily be appreciated that the tickets might as easily be arranged in a roll.

Referring now to FIGS. 2 to 4, the delivery head, indicated generally by the reference character 46, includes respective side panels 48 and 50 which are connected to a front panel 52 by means of front panel side flanges 54 and 56 which are tack-welded or otherwise secured to the side panels. A base 58 of the unit 46 is formed with edge flanges 60 and 62 which are tack-welded or otherwise secured to the side panels 48 and 50 along the lower edges thereof.

I mount respective ticket retainers 64 and 66 on the panel 52 by means of spacer posts 68 which also serve as edge guides for the strip of tickets 42.

My unit 46 includes a plurality of feed rollers 70, 72 and 74 mounted at spaced locations along a shaft 76 rotatably supported in the side panels 48 and 50. I form the front panel 52 with laterally spaced openings 78, 80 and 82 so positioned as to permit the driven feed rollers 70, 72 and 74 to cooperate with idler rollers 84, 86 and 88 mounted at spaced locations along a shaft 90 supported for rotary movement in the panels 48 and 50. Shaft 76 carries a pulley 92 for rotation therewith at one end thereof.

Referring again to FIG. 1, pulley 92 receives a belt 94 which is adapted to be driven by a pulley 96 carried by the output shaft of a speed reducer 96 driven by a motor 100.

Referring again to FIGS. 2 to 4, I tack-weld or otherwise secure side flanges 104 and 106 of a rear ticket guide 102 to the side panels 48 and 50 adjacent to the upper end of the unit. Preferably, I bend the lower edge of the guide 102 rearwardly so as to form a lip 108 which guides a ticket being fed upwardly through the head 46 along a path formed in part by the rear guide 102.

My head 46 includes a front guide 110 provided with respective ears 112 and 114 at the upper ends thereof which are received by pins 116 and 118 on panels 48 and 50 so as to mount the front guide 110 for pivotal movement around the common axis of the two pins 116 and 118. Preferably, I bend the lower edge of the guide 110 forwardly so as to form a lip 120 for catching the upper edge of a ticket moving upwardly and directing it into the space between the guides 102 and 110.

I form a bracket 122 with a flange 124 tack-welded or otherwise secured to the rear guide 102. Bracket 124 is adapted to support a switch 126 for vertically adjustable movement thereon so as to accommodate a range of sizes of tickets in a manner to be described more fully hereinbelow. Switch 126 may, for example, be mounted on the flange 124 by means of bolts 128 and 130 adjustably secured in slots 132 and 134 by means of nuts (not shown). Switch 126 includes an operating arm 136 which extends through registering openings 138 and 140 in the rear guide 102 and in the front guide 110 so as to be actuated by the leading edge of a ticket moving upwardly through the space between the two guides 102 and 110.

My unit 46 includes a folder bar 142 extending between the upper ends of a pair of levers 144 and 146. Respective pivot shafts 148 and 150 on the side panels 48 and 50 rotatably support the levers 144 and 146. A pair of springs 152, and 154, the respective lower ends of which are secured to points on the levers 144 and 146 below their respective pivots, are secured at their upper ends to pins 156 and 158 so as normally to urge the levers 144 and 146 to rotate in a clockwise direction as viewed in FIG. 2.

A bar 160 extending between the lower ends of the levers 144 and 146 receives the upper end of a link 162, the lower end of which is formed with a slot 166 for receiving a crankpin 164. Crankpin 164 is supported on a plate 168 carried by the shaft 170 of a motor 172. In the relative positions of the parts illustrated in FIG. 2, springs 152 and 154 acting on the lower ends of the levers 144 and 146 move the link 162 to a position at which the lower end of the slot 166 engages the pin 164.

My ticket dispensing unit includes a knife slide 174 provided with spaced upper slots 176 and 178 received by pins 180 and 182 carried by the panel 52. A lower slot 184 receives a third pin 186 carried by the panel 52. Screws or the like 188 and 190 disposed outboard of the lateral edges of the upper portion of the panel 52, as shown in FIG. 3, secure a knife blade 192 to the slide 174 for movement therewith along a path in front of panel 52. I secure the respective ends of a spring 194 to a pin 196 on the slide 174 and to a pin 198 on panel 52 so as normally to urge slide 174 to a position at which the upper ends of the respective slots 176, 178 and 184 rest on the pins 180, 182 and 186. A rearwardly extending ear 200 formed on the slide 174 carries a pivot pin 202 which receives the upper end of the link 204, the lower end of which is provided with a slot 206 which receives a crankpin 164. My unit includes a delivery platform 208 against which a folded but not yet cut ticket is held by the bar 142 in the rest condition of the machine in a manner to be described.

I mount a full cycle cam **210**, having a recess **212** therein, on the shaft **170** for movement therewith. A follower **214**, adapted to be operated by the cam **210**, operates a switch **216** by means of a linkage indicated schematically at **218**.

Referring now to FIG. **5**, one form of electrical circuit which may be used to control the operation of my ticket dispensing head includes respective conductors **220** and **222** connected to the terminals **224** and **226** of a suitable source of electrical potential. I connect a selection push-button switch PB in series with a coin-responsive mechanism **228** and a relay winding R between the conductors **220** and **222**. Switch **216** is so arranged as to engage a lower contact when the follower **214** of cam **210** is in the recess **212**. Moreover, when the leading edge of a ticket does not engage the switch arm **136**, switch **126** is closed. I connect switch **216**, its lower contact, motor **100** and switch **126** in series between the conductors **220** and **222**. It will thus be appreciated that, with motor **172** deenergized and with no ticket engaging arm **136**, motor **100** will be energized to drive the rollers **70**, **72** and **74** until the leading edge of a ticket engages arm **136** at which time switch **126** opens to deenergize motor **100**. In my system, this is the normal condition of the parts.

When a sum in money aggregating the purchase price of a ticket has been deposited in the coin mechanism **228**, the selection circuit is readied. When, under this circumstance, push-button PB is operated winding R is energized to close a switch R2 to energize motor **172**. As soon as the motor begins rotating, follower **214** moves arm **216** into engagement with the upper contact associated therewith. At the same time, switch R1 closes to complete a holding circuit through switch **216** to by-pass both the push-button switch PB and the coin mechanism **228**. Motor **172** then continues to drive its shaft until, upon the completion of a revolution of the motor shaft, follower **214** drops back into recess **212** and switch **216** moves away from its associated upper contact to interrupt the motor holding circuit.

In the particular sequence of operations which I have selected for my ticket vending head, in the rest condition of the machine, the parts occupy the positions illustrated in the drawings. The crankpin **164** holds link **162** in the position shown against the action of springs **152** and **154**. At the same time, spring **194** holds the breaker blade slide **174** in the position shown at which the upper ends of slots **176**, **178** and **184** engage the pins **180**, **182** and **186**. Moreover, since a ticket is in engagement with the arm **136**, switch **126** is open.

It will readily be appreciated that in practice cabinet **10** may house a plurality of the units **46** adapted to sell respective tickets of different kinds and at various prices and that a coin mechanism **228** common to all of the units might be provided. The unit, further, might be capable of making change. For purposes of simplicity, however, I have illustrated only one unit.

Under the initial conditions described above, assuming that a customer desiring to make a purchase has deposited in the mechanism **228** an amount of money equal to the purchase price of a ticket **42** adapted to be sold by the unit **46**, he then pushes switch PB to complete the circuit of winding R to close switches R1 and R2 to energize motor **172**. Shortly after its energization, motor **172** drives cam **210** to move follower **214** to engage switch **216** with the upper contact associated therewith to complete the holding circuit for the winding R. The motor **172** rotates in a counterclockwise direction, as viewed in FIG. **2**. In the course of approximately the first 90° of rotation of shaft **170** and hence of crankpin **164**, the springs **152** and **154** acting on the lower ends of the levers **144** and **146** swing the clamping bar **142** in a clockwise direction, as viewed in FIG. **2**. In the course of this operation, the ticket which had been in engagement with the switch arm **136** moves forwardly and is folded along the line **44** of perforations, or the like, positioned just above the cutting edge of the breaker blade **192**. Finally, the folder bar **142** moves the ticket into engagement with the delivery guide **208** against which the ticket is held under the action of springs **152** and **154**. During this first 90° of movement of the crankpin **164**, slide **174** remains in its initial position. However, by the end of the first 90° of movement of the crankpin, it has reached the upper end of the slot **206** so that for approximately the next 90° of movement of the crankpin it drives the slide **174** upwardly against the action of spring **194**. As a result, blade **192** moves upwardly along a path parallel to the path of movement of the string of tickets toward the line of weakness **44** along which the leading ticket has been folded by the folder bar **142**. In the course of this movement, the breaker blade **192** severs the leading ticket from the remaining tickets in the string precisely along the line **44** of perforations, or the like, between the leading ticket and the next ticket in the string. Over the next 90° of rotation of the crankpin **164** or from approximately 180° to 270°, spring **194** is permitted to retract blade **192**. Over the extent of movement of the crankpin **164** from about 90° to 270°, the link **162** idles so that the leading ticket is clamped against the delivery plate **208** by the bar **142**. During the final 90° of revolution of the crankpin **164**, it engages the lower end of slot **166** to pull link **162** downwardly, as viewed in FIG. **2**, to cause the folder bar **142** to be restored to its initial position against the action of springs **152** and **154**.

Upon arrival of the crankpin **164** at its initial position, follower **214** falls into the recess **212** and switch **216** moves away from the upper contact to interrupt the holding circuit of motor **172** and into engagement with the lower contact. As the switch **216** engages its lower contact, the circuit of motor **100** will again be complete since switch **126** closed when the bar **142** moved the leading ticket away from the switch arm **136**. As motor **100** drives, the string of tickets is advanced until the next ticket moves to a position at which it engages switch arm **136** to move the switch **126** to its open position. Coin mechanism **228**, of course, has been reset in a manner known to the art. The unit is now ready for the next dispensing operation.

It will be seen that I have accomplished the objects of my invention. I have provided a ticket vending head which readily accommodates a wide range of ticket sizes without requiring substitution of parts. My ticket vending head easily accommodates relatively small changes in ticket size without substitution of parts. My apparatus does not require that the tickets be provided with ticket advancing notches or holes. My vending head does not require any critical relative positioning of parts. It accommodates considerable error in the line of weakness spacing along the length of a string of tickets.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of my claims. It is further obvious that various changes may be made in details within the scope of my claims without

departing from the spirit of my invention. It is, therefore, to be understood that my invention is not to be limited to the specific details shown and described.

Having thus described my invention, what I claim is:

1. Apparatus for delivering tickets from a string of individual tickets separated by lines extending across said string including in combination, a blade, means mounting said blade for movement along a path between an inactive position and an active position, means for moving a string of tickets past said blade along a path generally parallel to the path of movement of said blade, means for disabling said string moving means with one of said separating lines located beyond said blade edge in the direction of movement of said string, means for folding said string along said one separating line and over said edge in the inactive position thereof, means for driving said blade from said inactive position to said active position to sever said string along said one separating line and means responsive to said blade driving means for activating said string moving means.

2. Apparatus as in claim 1 in which said folding means includes a ticket engaging member, means mounting said member for movement from a first position through a second intermediate position at which it engages a ticket located beyond said one separating line in the direction of movement of said string and to a third position at which said string is folded along said one separating line, means for biasing said member for movement from said first position to said third position, means for holding said member in said first position against the action of said biasing means and means for releasing said holding means.

3. Apparatus as in claim 2 including a delivery plate, said biasing means holding a ticket of said string against said plate in said third position.

4. Apparatus as in claim 2 in which said holding means comprises a normally deenergized motor, a crankpin adapted to be driven by said motor, and means including a link having a slot receiving said crankpin for connecting said crankpin to said motor, and in which said releasing means comprises means for energizing said motor.

5. Apparatus as in claim 4 in which said member is a bar, in which said mounting means comprises a lever, in which said biasing means comprises a spring urging said arm to rotate in a direction to move said bar from said first to said second position and in which said holding means comprises means connecting said link to said arm.

6. Apparatus as in claim 1 including means biasing said blade to said inactive position and in which said blade moving means comprises a motor, a crankpin adapted to be driven by said motor and a link having a slot receiving said crankpin and means connecting said link to said blade.

7. Apparatus as in claim 6 in which said holding means comprises a second link having a slot receiving said crankpin and means connecting said second link to said folding means.

8. Apparatus for delivering tickets from a string of individual tickets separated by lines extending across said string including in combination, means for moving a string of tickets from a supply along a predetermined path, a ticket separating blade, means mounting said blade for movement along a path generally parallel to and at one side of said ticket path from a first position along the ticket path to a second position along the ticket path, a folder bar, means mounting said folder bar for swinging across said ticket path from a rest position located along said ticket path beyond said first position and at the other side of said ticket path, means responsive to movement of said string along said path for interrupting said ticket moving means with one of said separating lines between said first and second position, means for sequentially swinging said folder bar across said ticket path to fold said string along said one separating line and for moving said blade from said first position to said second position to sever said string along said one separating line and means responsive to said last-named means for actuating said string moving means.

9. Apparatus as in claim 8 in which said string moving means comprises friction wheels and means for driving said wheels and in which interrupting means comprises a switch responsive to the leading edge of the leading ticket of said string.

10. Apparatus as in claim 8 in which said means for sequentially moving said bar and said blade comprises coin responsive means.

11. Apparatus as in claim 8 including a ticket delivery guide, said folder bar mounting means comprising a lever and means mounting said lever for pivotal movement, said means for swinging said bar comprising a spring biasing said lever to move said bar from said rest position across said path to urge a ticket against said guide, means for holding said bar against the action of said biasing means and means for disabling said holding means.

12. Apparatus as in claim 8 in which blade mounting means comprises a slide, said blade moving means comprising a spring for biasing said slide to position said blade in its first position and means for driving said blade to its second position against the action of said slide.

13. Apparatus as in claim 8 in which said sequential moving means comprises a shaft having a home position, said apparatus including means responsive to arrival of said shaft in its home position for actuating said strip moving means.

14. Apparatus as in claim 8 in which said folder bar mounting means comprises a lever and means mounting said lever for pivotal movement and in which said blade mounting means comprises a slide and in which said sequential moving means comprises a first spring biasing said lever to move said bar from said rest position across said path to fold said string, a second spring for urging said slide to a position corresponding to the first position of said blade and common means for first holding said lever against the action of said first spring and then releasing said lever to permit said first spring to act and then driving said slide against the action of said second spring.

15. Apparatus as in claim 14 in which said common means comprises a motor, a crankpin adapted to be driven by said motor, a first link having a slot for receiving said crankpin, means connecting said first link to said lever, a second link having a slot therein for receiving said crankpin and means connecting said second link to said slide.

16. Apparatus as in claim 8 including respective string retainer and edge guides for guiding said string of tickets along said path.

17. Apparatus for delivering tickets from a string of individual tickets separated by lines extending across said string including in combination, a blade having an edge, means mounting said blade for movement along a

path between an inactive position and an active position, means for moving a string of tickets past said blade along a path generally parallel to the path of movement of said blade, means for disabling said string moving means with one of said separating lines located beyond said blade edge in the direction of movement of said string and in the inactive position of said blade, means adapted to be activated sequentially to swing said folder bar across said ticket path and for moving said blade from said inactive position to said active position, coin-responsive means for activating said sequentially operating means and means responsive to operation of said sequentially operating means for actuating said string advancing means.

18. Apparatus as in claim 17 in which said disabling means comprises a normally closed switch having an actuating element and means mounting said switch with the actuating element thereof in the path of the leading edge of said string.

19. Apparatus as in claim 18 in which said sequentially operating means comprises a first motor and a full revolution switch associated with said motor and in which said string moving means comprises a second motor, a source of power and means including said normally closed switch and said one revolution switch for connecting said second motor to said source.

* * * * *

Exhibit T

Redacted

Exhibit U

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Exhibit V

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Exhibit W

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Exhibit X

United States Patent [19]

Wescoat

[11] **3,894,669**

[45] **July 15, 1975**

[54] **FRICTION FEED TICKET DISPENSER**

[75] Inventor: **George F. Wescoat**, Manchester, N.H.

[73] Assignee: **Granite State Machine Company**, Manchester, N.H.

[22] Filed: **Nov. 19, 1973**

[21] Appl. No.: **416,855**

[52] **U.S. Cl.** **225/103**; 30/241; 83/212; 269/315

[51] **Int. Cl.** **B65h 35/10**

[58] **Field of Search** 225/103, 93, 96.5; 83/212, 83/210, 176, 436, 17, 422, 649, 372, 373, 268, 269, 391, 392, 393, 394, 395; 269/315, 316, 317, 318, 319, 320

[56] **References Cited**

UNITED STATES PATENTS

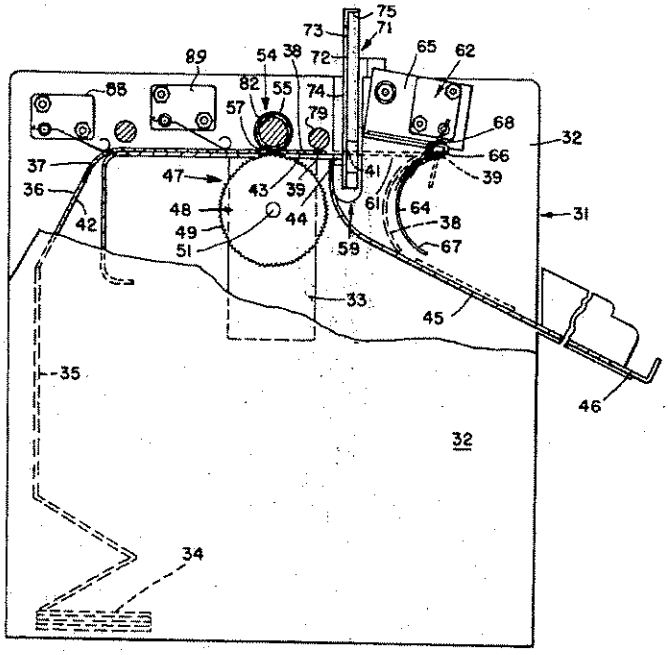
2,269,714	1/1942	Fenton	83/212
2,687,174	8/1954	Richens	83/176 X
3,558,254	1/1971	Cahill	83/649 X
3,748,937	7/1973	Long	83/422 X

Primary Examiner—J. M. Meister
Assistant Examiner—Fred A. Silverberg
Attorney, Agent, or Firm—Pearson & Pearson

[57] **ABSTRACT**

A dispenser especially for lottery tickets feeds a web of tickets, by means of a knurled roll, rubber roll pressure nip with the leading ticket advancing across a platform, through a breaker zone, across a gap to a stop. The leading ticket is bowed as it bridges the gap to assure straightness and to resist collapse under breaker bar impact. The breaker bar impacts near a perforated line, with a karate type blow, to separate each successive ticket. If slightly out of registration, there is no accumulation of error as may occur with a cutter bar.

8 Claims, 4 Drawing Figures



PATENTED JUL 15 1975 3,894,669

SHEET 1

Fig. 1.

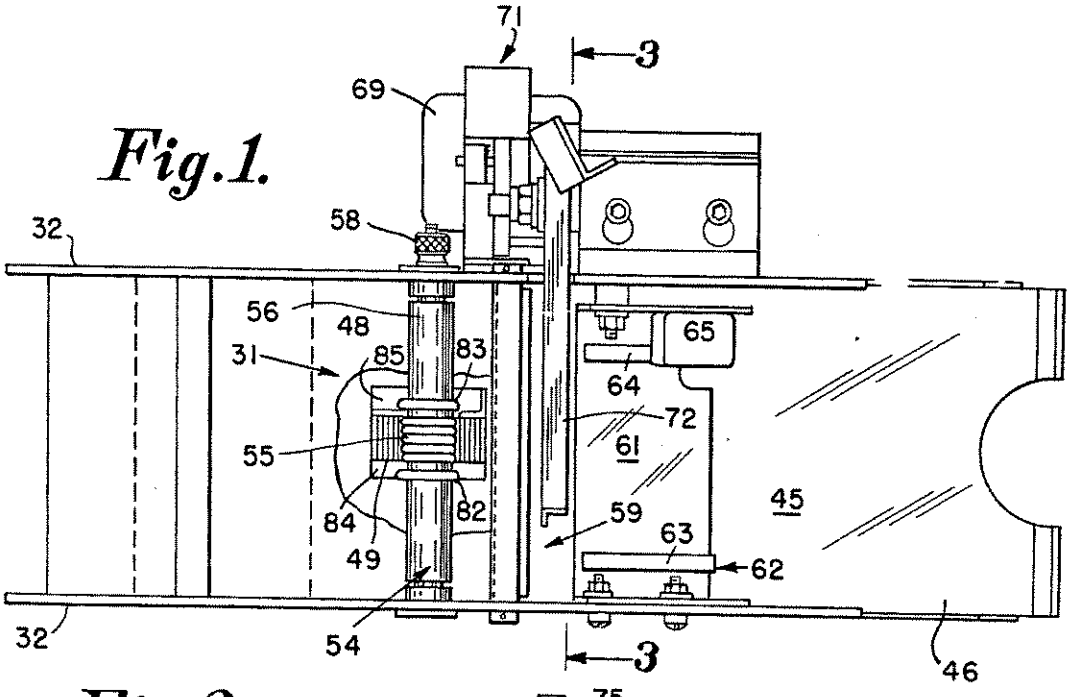


Fig. 2.

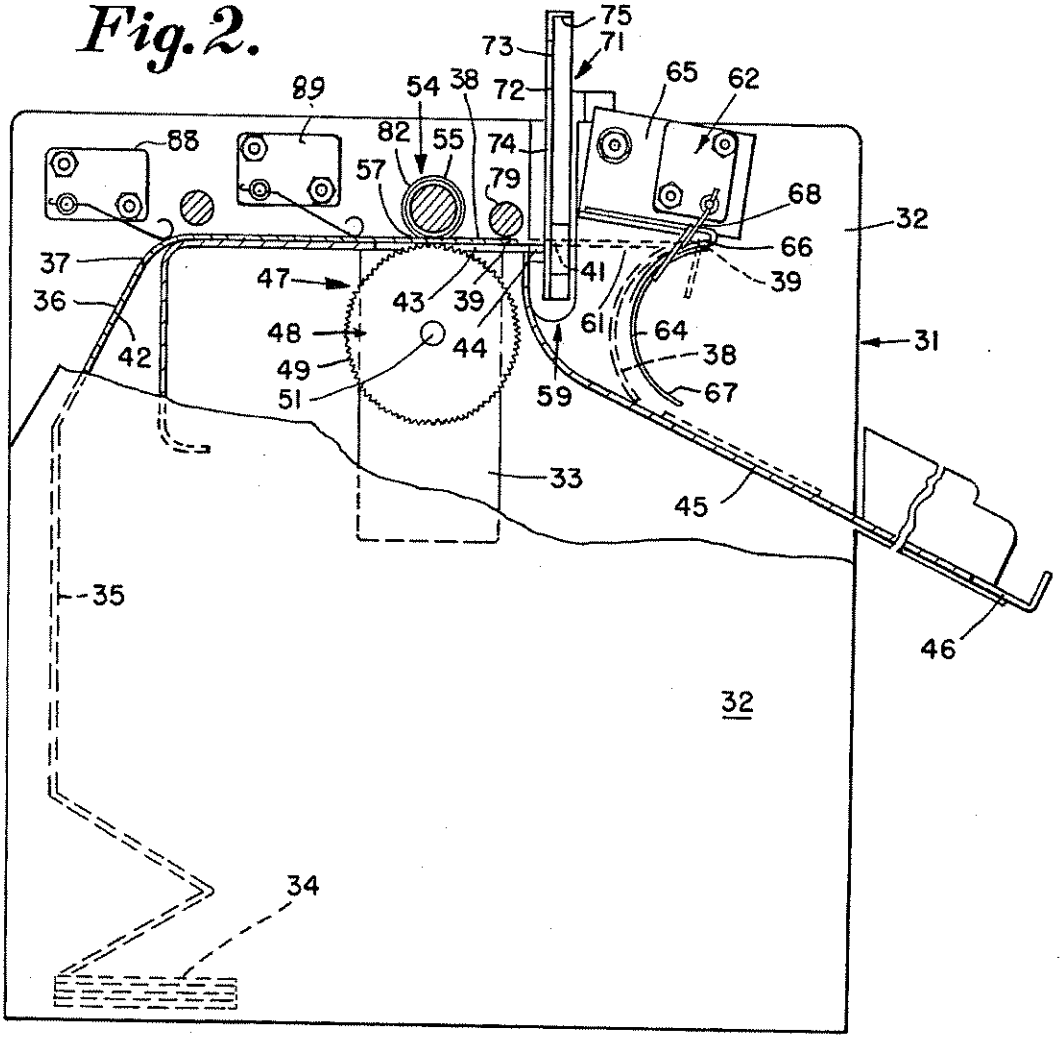


Fig. 3.

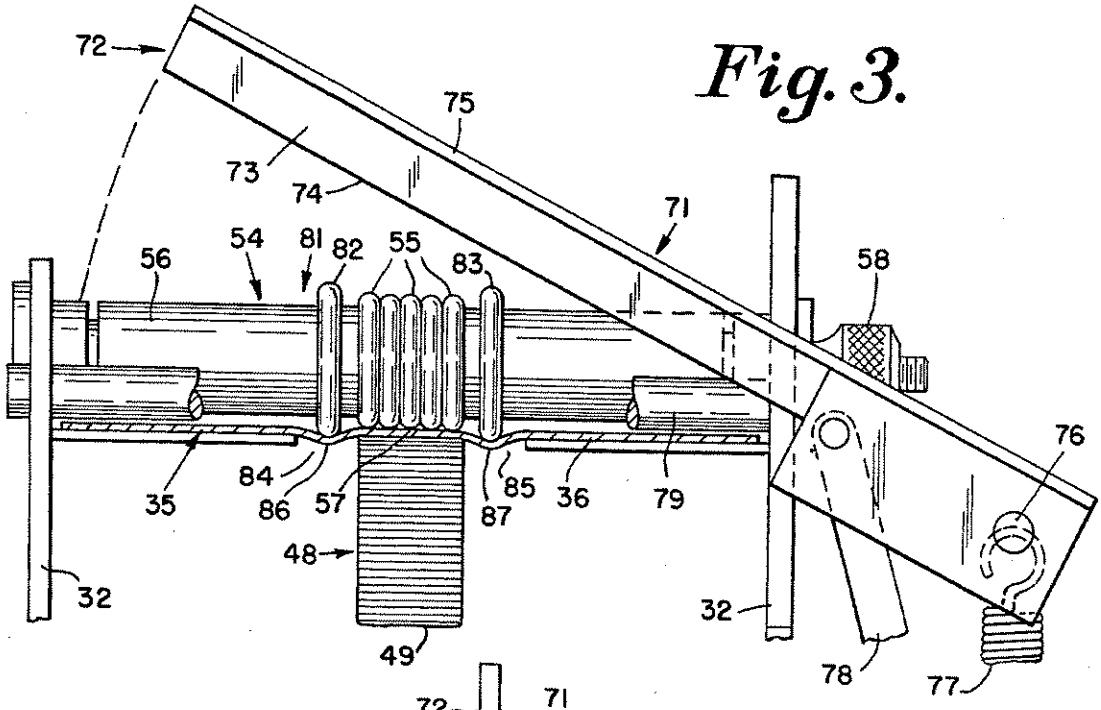

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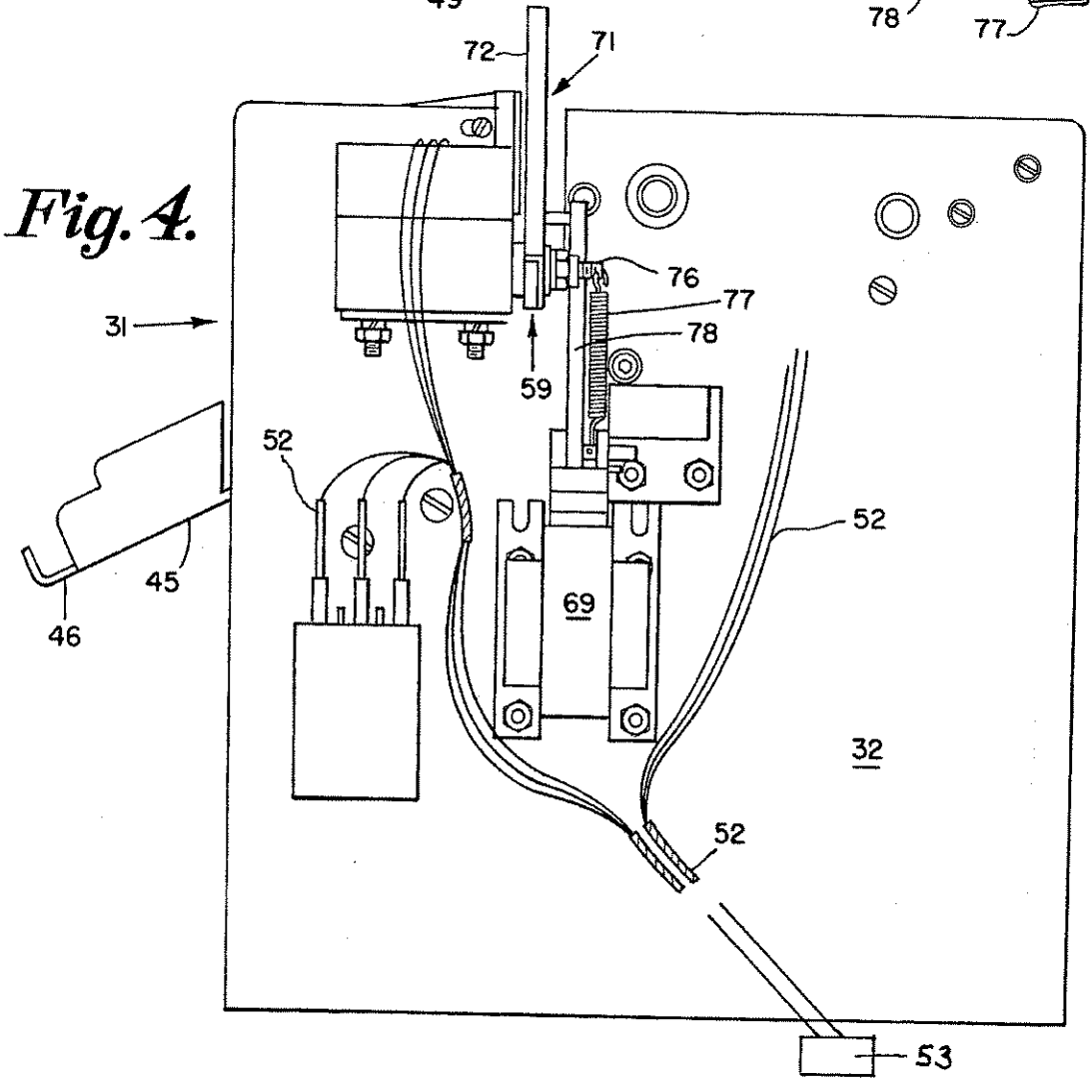
Fig. 4.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FRICTION FEED TICKET DISPENSER

BACKGROUND OF THE INVENTION

The dispensing of tickets for lotteries has long presented problems not found, for example, with theatre tickets, insurance policies and the like because of the intrinsic value of the lottery tickets. Usually the automatic lottery ticket dispensers are placed in locations, such as state liquor stores, wherein there are no skilled operators ready to correct malfunctions such as the inadvertent dispensing of all of the tickets at once or the jam-up of a machine in rush purchase hours.

It has heretofore been proposed in U.S. Pat. No. 3,612,372 to Richer of Oct. 12, 1971, to use registration pin chain feed and a registration apertured web of tickets to be sure of a single ticket feed, the actuation coming from the closing of a door after the customer has written his name on the ticket. The tickets are torn off the web by the purchaser.

In U.S. Pat. No. 3,734,261 to Richer of May 22, 1973, the tickets are also advanced by registration holes and registration pin chains, but are cut off by an upwardly moving pivoted knife. A tension bar assures a clean cut and clamps are provided to hold down the tickets against the lift-off effect of the up moving knife.

The tearing off of tickets and the cutting off of tickets, while normally satisfactory, can create considerable dispensing difficulty when the tickets used in a particular state are of relatively flimsy, limp material or when a batch of tickets is printed inaccurately. Some states do not approve of registration apertures in the web of tickets so that they must be fed by friction. Prior art devices do not adapt themselves to accurate control under these circumstances.

SUMMARY OF THE INVENTION

In this invention the friction feed is accomplished by a lower knurled surface roll and upper rubber faced rolls which advance the continuous ticket web across a horizontal platform having a forward edge corresponding to a bed plate. When the user inserts the appropriate note in the note acceptor, the leading, or endmost, ticket advances from the platform until its perforated line connection to the next ticket is aligned with the platform edge at which time the leading edge of the ticket has entered the arcuate stop means and closed a limit switch. The limit switch opens the circuit to the motor controlling the knurled feed roll while closing a circuit to the solenoid for lowering the breaker bar. The ticket is bridging the gap between the platform edge and the stop and has been given a double bow by a pressure ring and slot which rigidifies and stiffens the ticket like a tautly held paper readying for the impact of the breaker bar. Because the perforated line is proximate the platform edge and the ticket is straight and taut, the bar can strike with a sharp karate type blow exactly on the line, or even slightly away therefrom, and still cause the ticket to separate exactly on the line without lint, cuttings or continual accumulation of error. The stop means continues to support the leading edge of the ticket while the horizontal portion of the breaker bar engages the trailing portion to snap the latter down into a chute while flipping the ticket over to reveal the printed underside. Thus the costly registration chains are avoided and precise, successive separation of tickets obtained by the versatility of the blunt breaker bar means in compensating for any feed errors.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view of a dispenser constructed in accordance with the invention;

FIG. 2 is a side elevational view of the apparatus shown in FIG. 1 with parts broken away;

FIG. 3 is an enlarged fragmentary front elevation showing the breaker bar means and the ticket bowing means and the feed roll means of the invention; and

FIG. 4 is a side elevational view of the apparatus showing the solenoid for actuating the breaker bar.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The ticket dispenser apparatus **31** of the invention is contained in a framework **32** which fits within the main housing of a conventional lottery ticket dispenser, such as shown in the abovementioned U.S. Pat. Nos. 3,612,372 and 3,734,261 and now well known in the art. The mechanism is actuated by a commercially available note acceptor, not shown, which closes an electric circuit to the feed roll motor **33** upon acceptance of the customer's paper money.

The framework **32** includes a supply compartment **34** for a continuous web **35** of individual lottery tickets **36**, separated from each other by perforated lines **37**, the web **35** being preferably fan folded as shown. Each successive leading, or endmost, ticket **38** has a leading edge **39**, a trailing edge portion **41** and has printed indicia **42** on the underside, the web being advanced with the printed side down. The framework **32** also includes a horizontal platform **43** with a forward edge **44** which serves as a bed plate as will be explained hereinafter.

A ticket delivery chute **45** is provided having a terminal end **46** extending outside the main housing so that tickets dropping down the chute may be picked up by the purchaser.

Powered friction feed means **47** includes a lower feed roll **48** having a knurled surface **49** and fast on a shaft **51** driven by the electric feed roll motor **33** when the electric circuit **52** is closed by the note acceptor start switch **53**. Means **47** also includes an upper feed roll **54**, formed by a plurality of rubber rings **55** mounted on a shaft **56** and all of predetermined identical diameter to form a pressure or feed nip **57**. The clearance or pressure at nip **57** is adjusted by the knurled nuts **58** which tighten the shaft **56** in place in slots in framework **32**.

It will be seen that upon rotation of the knurled feed roll, when a note has been accepted by the note acceptor, the web **35** will be advanced to advance the leading, or endmost, ticket **38** across the platform **43**, beyond the edge **44**, through the segregation station **59** and across the gap **61** until the leading edge **39** engages the stop means **62**.

Stop means **62** includes a pair of arcuate elements **63** and **64** depending from the block **65** and each having a recess **66** for receiving and intercepting the leading edge as well as a curved portion **67** which supports the leading edge **39** of the segregated ticket while its trailing edge portion **41** is impacted downwardly to flip the ticket over, printed side up, as it falls down chute **45** (FIG. 2).

Stop means **62** also includes a limit switch **68** which is closed by the contact of the leading edge **39** when that edge is within recess **66** and is exactly one ticket length from the forward edge **44** of platform **43**, the

switch 68 opening the circuit to motor 33 to stop the feed roll means 47. Switch 68 also closes a circuit to the solenoid 69 of the breaker bar means 71 to actuate the breaker bar thereof.

Breaker bar means 71 includes the breaker bar 72, which is of right angular cross section with a vertical impact portion 73, having a blunt edge 74 and a horizontal portion 75 for engaging the trailing edge portions 41 of each successive ticket at segregation station 59. As best shown in FIG. 3, breaker bar 72 is pivoted at 76 and provided with a return spring 77, so that when it is drawn downwardly by link 78 and solenoid 69 the breaker bar is lowered with great speed alongside the bed plate formed by forward edge 44 to break off the endmost ticket 38 at the perforated line 37.

A hold down roll 79 extends across framework 32 to prevent any snap-up of the next successive ticket when the breaker bar delivers its blunt karate type blow.

If the web 35 is formed of relatively thin paper which is limp and non-self-supporting, the leading ticket may sag down as it seeks to bridge the gap 61 and thereby miss the stop means and fail to actuate switch 68. This may result in the entire web feeding out on the floor at great loss to the state and great good fortune to the purchaser. Similarly, such a thin web may result in the endmost ticket merely being wiped downwardly by the breaker bar, rather than being separated, thus failing to deliver the ticket. Upon the next actuation, the tickets may then jam up in the stop means.

To overcome any possibility of such misfeeds occurring, ticket bowing means 81 is provided comprising a pair of rubber rings 82 and 83 of enlarged diameter, each having the lower portion thereof received in one of a pair of slots 84 and 85 in platform 43. The slots 84 and 85 extend in the direction of travel of the web and the diameter of rings 82 and 83 is predetermined to create a bow or axially extending temporary corrugation 86 and 87 in each endmost ticket 38 to lend strength and rigidity thereto so that the ticket will advance straight and horizontally across the gap without sag to contact recess 66 and limit switch 68. The bowing means, or guide means, 81 performs a second function in making the ticket taut as it bridges the gap, like a piece of cloth to be cut by a knife, so that even if the breaker bar 72 should not impact exactly at each successive perforated line, the ticket will still be segregated at that line and no accumulation of error will occur.

Suitable switches 88 and 89 are included in circuit 52, to signal that tickets are exhausted so that the note acceptor will not accept money with the machine unable to dispense.

I claim:

1. In a lottery ticket dispenser of the type having a continuous web of individual lottery tickets, separated by perforated lines, guided from a supply compartment to a platform proximate a delivery chute, the combination of:

powered friction feed mechanism, including a lower knurled roll forming a feed nip with an upper rubber roll for advancing said web across said platform;

stop means, mounted on said dispenser one ticket's length beyond said platform, and including an arcuate element having a recess for receiving the leading edge of each successive endmost ticket advanced therealong and a limit switch in said recess for stopping said feed mechanism when closed by contact with said leading edge;

ticket bowing means, associated with one of said feed rolls and said platform for bowing each successive endmost ticket bridging the gap between said platform and stop means for readying said ticket for severance, while assuring that the ticket travels straight to said stop means; and

breaker means including a breaker bar normally poised out of the path of said tickets proximate the edge of said platform, and power means for moving said bar downward to deliver a karate chop blow at the perforated line separating the endmost ticket engaging said stop means to separate said ticket from said web along said perforated line.

2. A dispenser as specified in claim 1, wherein:

said upper roll of said friction feed mechanism is freely rotatable and formed of a plurality of individual rubber rings encircling a shaft and each of identical outside diameter.

3. A dispenser as specified in claim 1, wherein:

said ticket bowing means comprises at least one slot in said platform extending in the direction of advance of said web and at least one rubber ring of greater diameter than the diameter of said upper roll and received in said slot;

whereby each successive ticket is distorted down into said slot by said ring to form a bowed portion to strengthen the resistance of said ticket to drooping or bending downwardly.

4. A dispenser as specified in claim 1, wherein:

said ticket bowing means is formed by a pair of slots, each on an opposite side of said lower roll in said platform, and a pair of rings on said upper roll, each extending into one of said slots to create a pair of temporary corrugations in each endmost ticket causing said ticket to be self-supporting in advancing from said platform to said stop means.

5. A dispenser as specified in claim 1, plus:

a hold down roll mounted to rotate proximate the edge of said platform near the path of movement of said breaker bar, said roll preventing upward movement of the next successive ticket in reaction to the impact of the downward moving breaker bar.

6. A dispenser as specified in claim 1, wherein:

the arcuate element of said stop means includes a curved portion adapted to support the leading front edge of each ticket segregated by said breaker bar, while the rearward edge of said ticket is impacted downwardly by said breaker bar to fall down said chute, the ticket thus flipping over to reveal the printing on the underside thereof.

7. Apparatus for dispensing one ticket at a time from a web of such tickets connected to each other by perforated lines, said apparatus comprising:

powered feed rolls having a pressure nip for continuously advancing said web with the leading ticket advancing from a platform edge, through a segregation station, across a gap to a stop in the path of the leading edge;

at least one said stop having a recess for receiving said leading edge and a limit switch in said recess for stopping said feed rolls when closed by contact with said edge;

guide means proximate said platform edge for bowing each successive leading ticket as it bridges said

gap to stiffen the same to travel in a straight path toward said stop;

pivoted breaker bar means operably mounted at said platform edge to move downwardly to strike each successive ticket engaging said stop with a blunt blow to break off said ticket at its perforated line of joinder to said web; and

a switch for starting said feed rolls to advance said web; and

electric circuit means, including said limit switch engaged by said leading edge at said stop for halting said feed rolls, and actuating said breaker bar

means to separate each successive leading ticket from said web.

8. Apparatus as specified in claim **7**, wherein:

said pivoted breaker bar means includes a breaker bar of right angular cross section, having a vertical portion with a blunt edge for impacting said tickets proximate the perforated line thereof and a horizontal portion for impacting the trailing portion of said tickets to cause the same to fall, while the leading portion of said tickets are still supported by said stop means.

* * * * *

Exhibit Y

United States Patent [19]

Hain et al.

[11] **Patent Number: 4,623,081**

[45] **Date of Patent: Nov. 18, 1986**

[54] **BURSTER APPARATUS FOR CONTINUOUS FORMS**

[75] Inventors: **David A. Hain**, Dundee; **Ian J. Walker**, Fife, both of Scotland

[73] Assignee: **NCR Corporation**, Dayton, Ohio

[21] Appl. No.: **793,862**

[22] Filed: **Nov. 1, 1985**

[30] **Foreign Application Priority Data**

Jun. 26, 1985 [GB] United Kingdom 8516154

[51] **Int. Cl.**[4] **B65H 35/10**

[52] **U.S. Cl.** **225/105**; 225/5; 225/100; 225/106

[58] **Field of Search** 225/100, 101, 106, 105, 225/5

[56] **References Cited**

U.S. PATENT DOCUMENTS

2,355,690	8/1944	Zent	225/100
2,618,336	11/1952	Davidson	225/5
4,261,497	4/1981	Roetter et al.	225/106 X
4,401,249	8/1983	Kadlecik et al.	225/97

FOREIGN PATENT DOCUMENTS

648941	1/1951	United Kingdom	225/105
703237	2/1954	United Kingdom .	
703300	2/1954	United Kingdom .	
703301	2/1954	United Kingdom .	
1437207	5/1976	United Kingdom .	

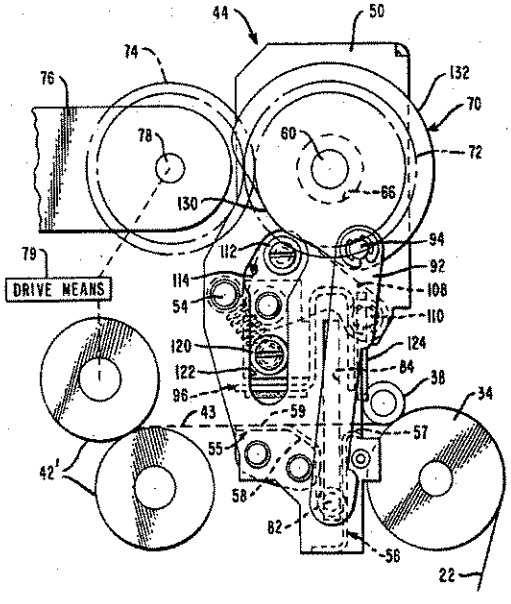
Primary Examiner—Frank T. Yost

Attorney, Agent, or Firm—Wilbert Hawk, Jr.; Albert L. Sessler, Jr.; Elmer Wargo

[57] **ABSTRACT**

The invention relates to a burster apparatus (**44**) for separating into sheets a continuous form (**22**) which has transverse weakened lines and which is arranged to be conveyed along a feed path (**43**) through the apparatus. The apparatus includes a movable burster rod (**82**) which extends across the feed path, and a clamp member (**96**) operable to clamp the continuous form (**22**) with a weakened line aligned with the path of movement of the burster rod. By means of cams (**70**) and link members (**92**), the rod (**82**) is arranged to be moved through the feed path (**43**) while the form (**22**) is clamped, the rod being inclined relative to the feed path. During this movement, the rod (**82**) progressively bursts the form (**22**) along the aligned weakened line from one edge of the form to the other, thereby effecting a reliable bursting of the form even if the weakened line is improperly formed.

10 Claims, 12 Drawing Figures



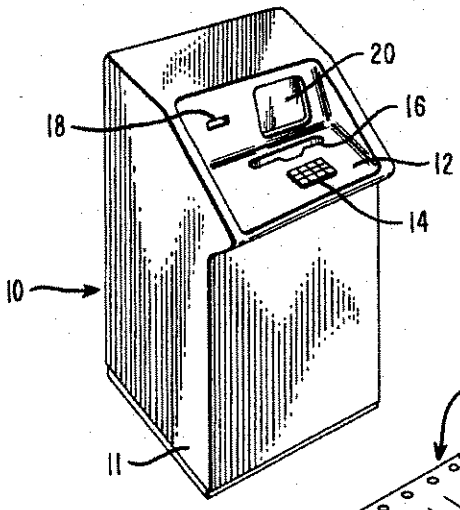
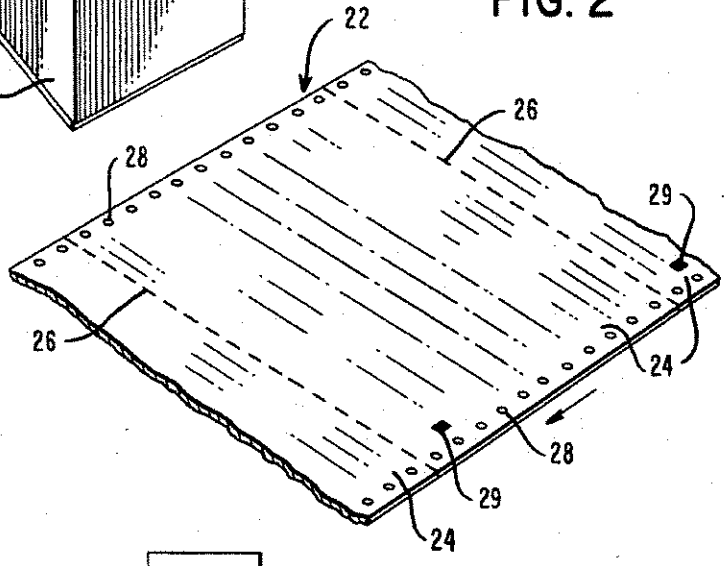


FIG. 1

FIG. 2



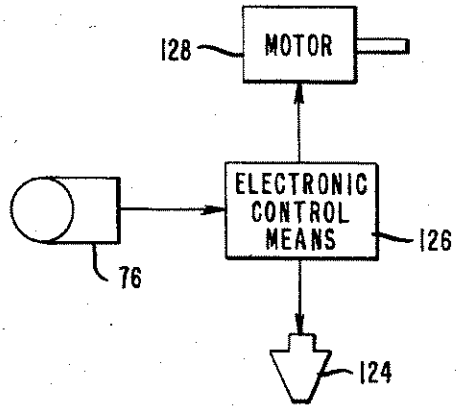
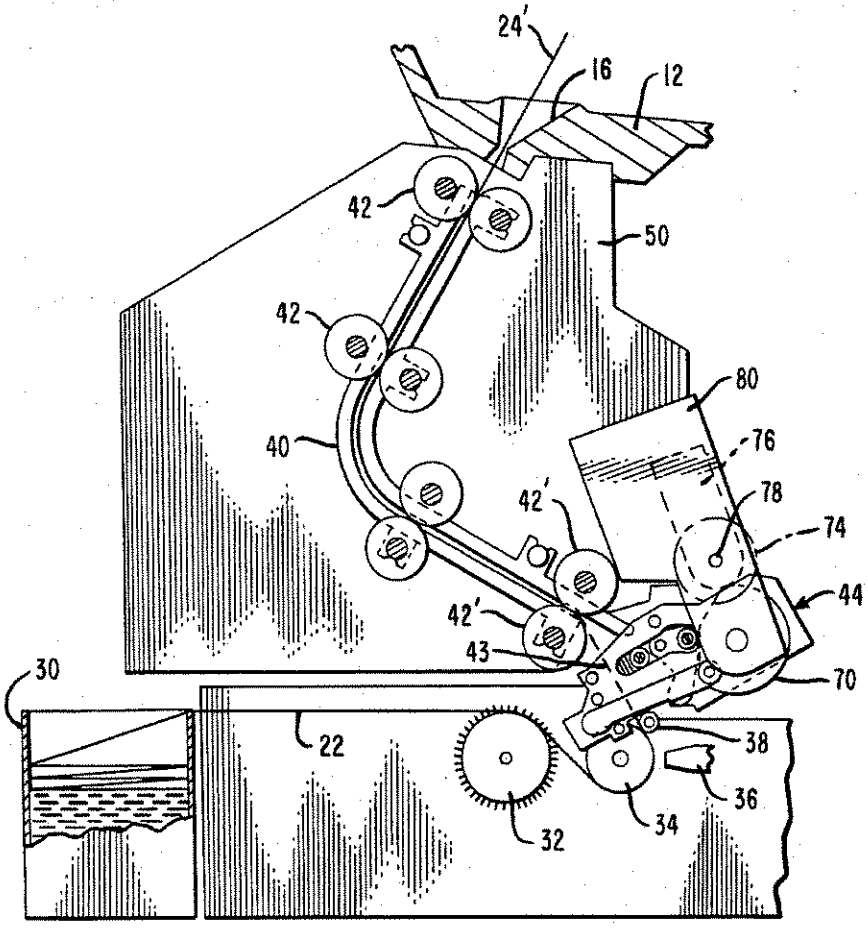


FIG. 11

FIG. 3



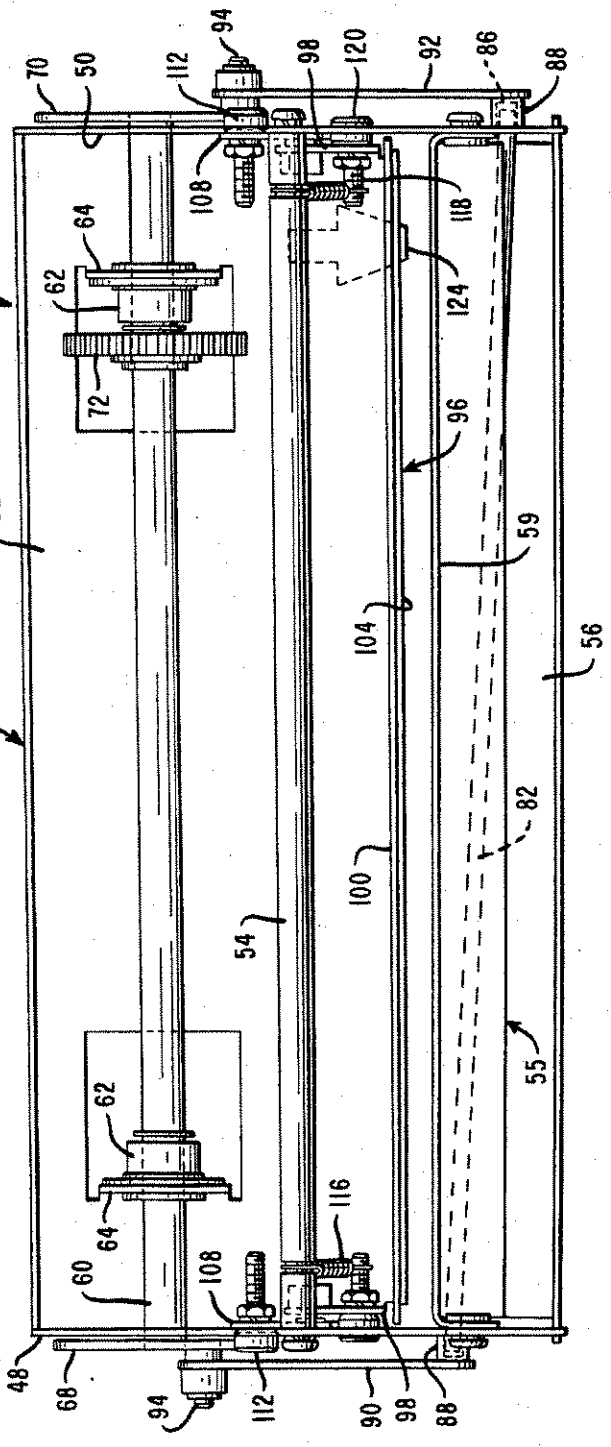

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FIG. 4

FIG. 5

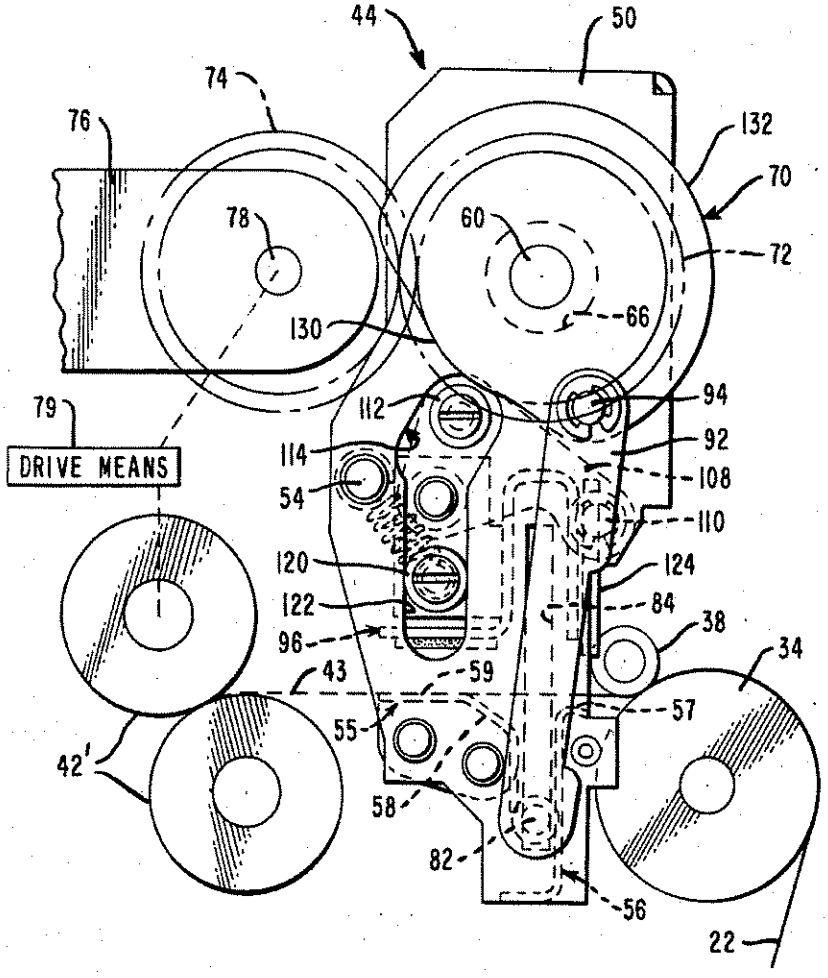
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FIG. 6

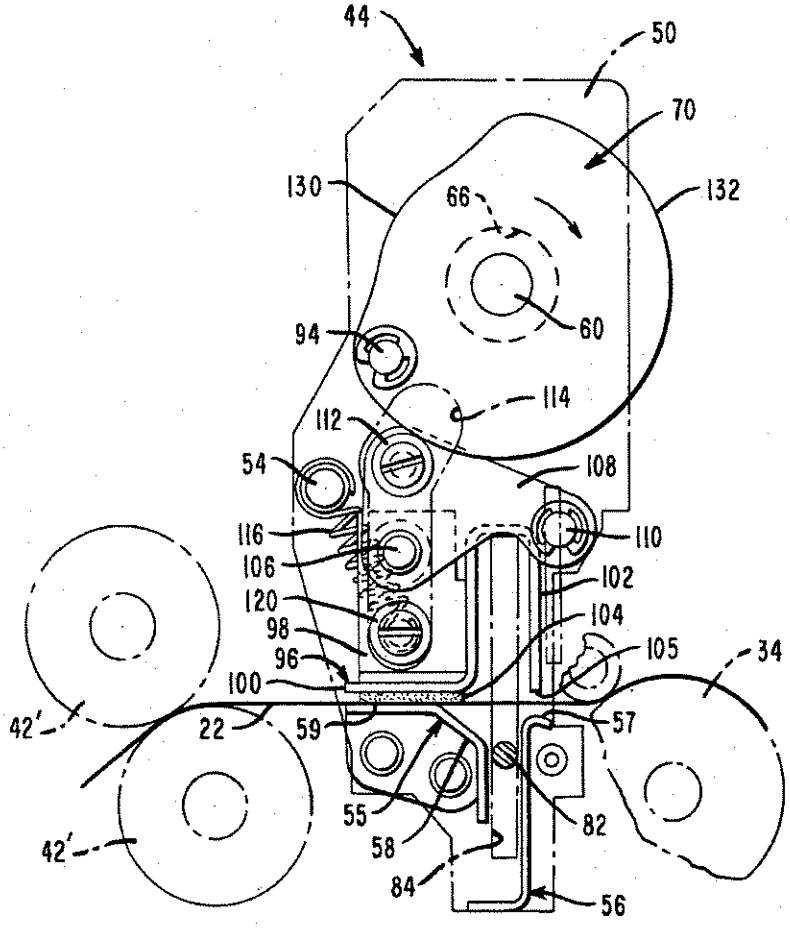
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FIG. 7

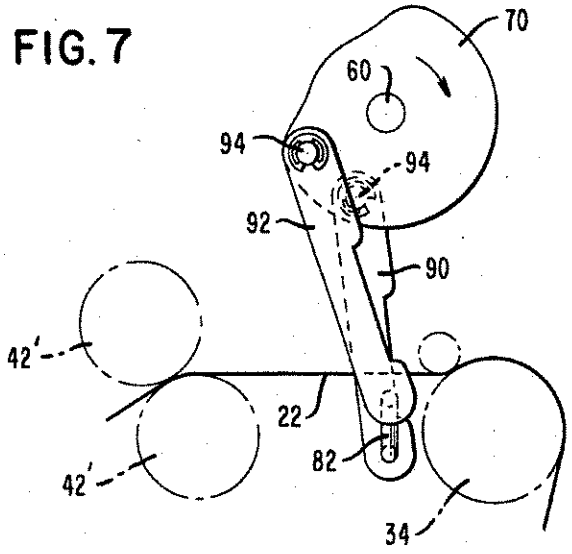
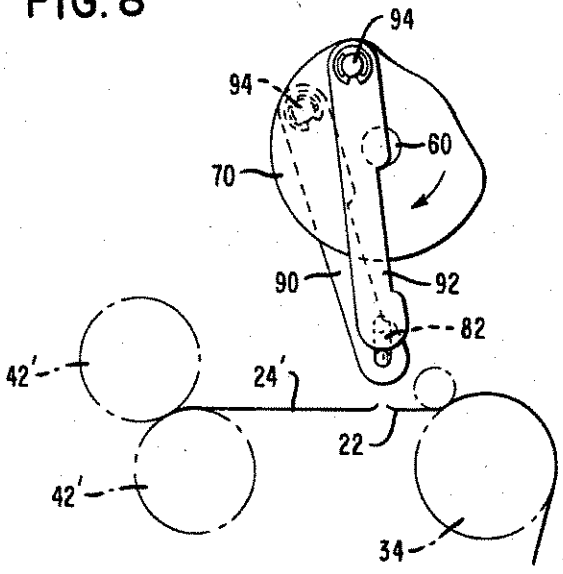


FIG. 8



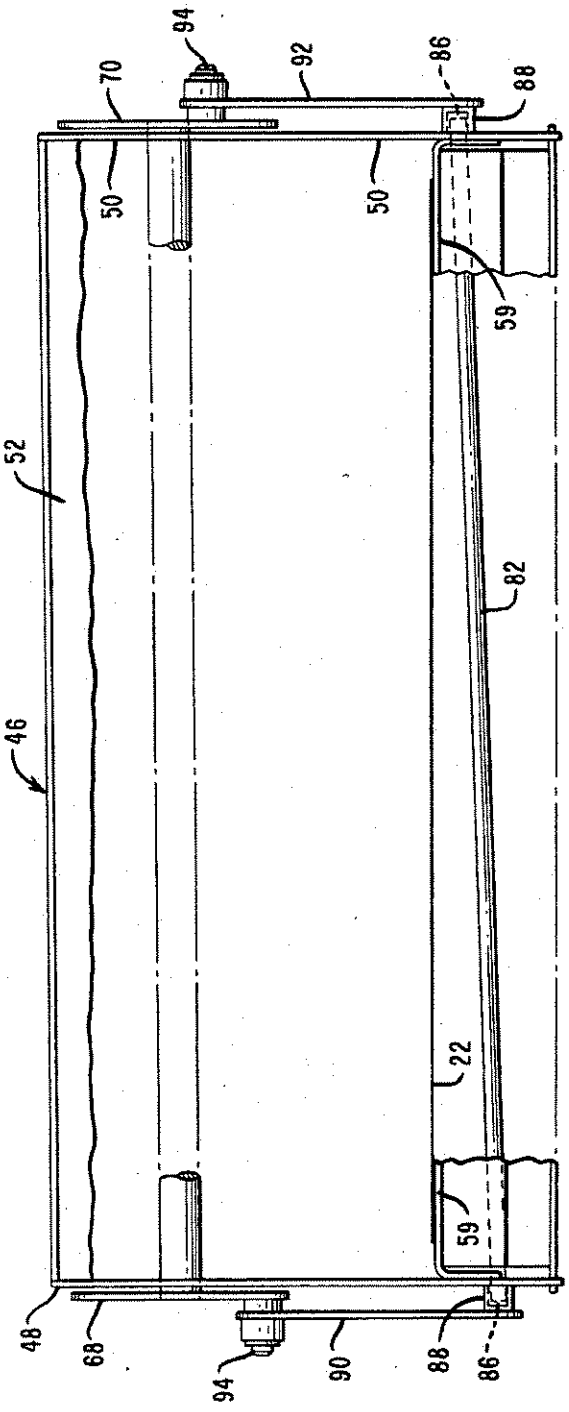


FIG. 9

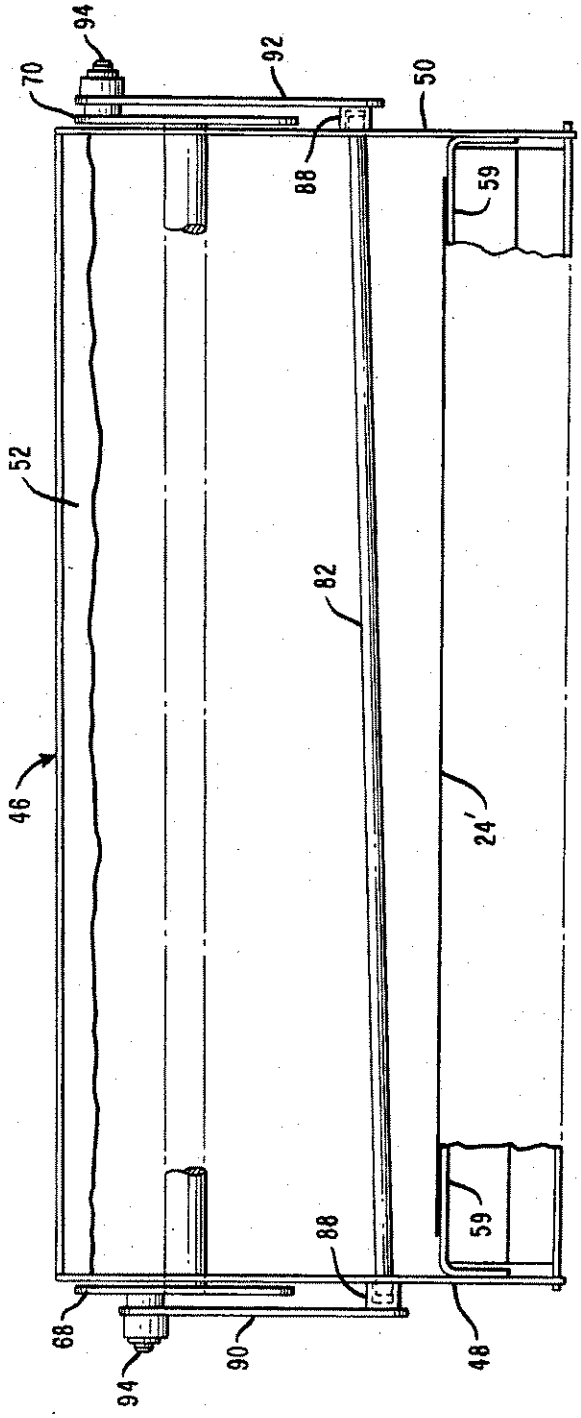


FIG. 10

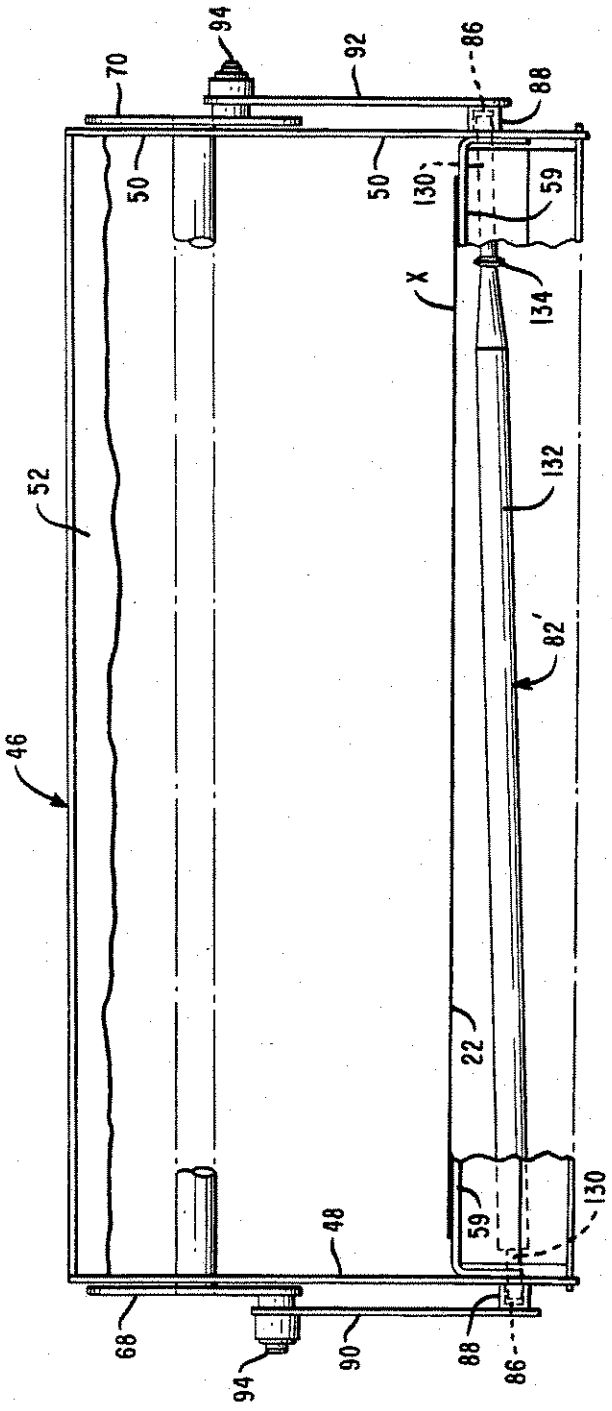

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FIG. 12

BURSTER APPARATUS FOR CONTINUOUS FORMS

BACKGROUND OF THE INVENTION

This invention relates generally to burster apparatus for separating a continuous web into sheets, the separation taking place along transverse, weakened lines. The invention has particular application, for example, to burster apparatus for separating continuous stationery into suitable form sizes.

Prior art paper bursters commonly include a pair of high speed rollers and a pair of low speed rollers between which a paper web passes, the speed differential between the high speed and low speed rollers causing the web to become tightly stretched. The tension built up in the web causes the web to split along a weakened line. Web separation can be assisted by burster means such as a bar or blade positioned at a weakened line. Such a prior art arrangement is disclosed, for example, in U.S. Pat. No. 4,401,249.

In another prior art arrangement, disclosed for example in U.S. Pat. No. 1,437,207, a paper web is clamped on one side of a weakened line, and a bursting tension is applied to the web on the other side of the weakened line so as to bring about a separation of the web along this line.

Such prior art burster arrangements, which rely on the build-up of tension in continuous forms stationery in order to bring about separation along a weakened line, have the disadvantage that improper bursting or tearing of the forms may occur, particularly if the weakened lines are improperly formed.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a reliable burster apparatus which substantially overcomes the disadvantage referred to above.

According to a preferred embodiment of the invention there is provided a burster apparatus for separating into sheets a web which has transverse weakened lines formed thereon, comprising: conveying means for conveying said web along a feed path through said apparatus; an elongated burster member extending across said feed path and having first and second ends; mounting means for mounting said first and second ends of said elongated burster member for movement in a plane which is substantially perpendicular to said feed path at said predetermined position in said feed path; clamping means for clamping said web with one of said weakened lines being held in said predetermined position, and moving means for moving said clamping means between clamping and non-clamping positions; and actuating means for individually moving said first and second ends of said elongated burster member in said plane so as to move said elongated burster member at an angle to said feed path to progressively burst said web at said weakened line at said predetermined position when said clamping means is in said clamping position; said conveying means being effective to move a separated sheet from said web after said clamping means is moved to said non-clamping position.

Various advantages of this invention will become apparent from the following description, claims and drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view of a self-service, financial terminal arranged to print and issue statements to bank customers;

FIG. 2 is a perspective view of a portion of a continuous form used in the terminal of FIG. 1;

FIG. 3 is a schematic, side-elevational view of a paper burster apparatus and transport mechanism made according to this invention and incorporated in the terminal of FIG. 1;

FIG. 4 is a front elevational view of the burster apparatus, shown in a non-operated condition;

FIG. 5 is an enlarged, elevational view of the right hand side of the paper burster as seen in FIG. 4, together with part of the transport mechanism;

FIG. 6 is a view similar to FIG. 5, but with certain parts omitted and with a clamping means included in the burster apparatus which is shown in a clamping position;

FIG. 7 is a schematic, side-elevational view of parts of the burster apparatus at a point in a cycle of operation of the apparatus immediately prior to the continuous form being burst;

FIG. 8 is a view similar to FIG. 7, but showing the relevant parts of the burster apparatus immediately after the continuous form has been burst;

FIG. 9 is a front, elevational view of parts of the burster apparatus as shown in FIG. 7, and additionally shows part of the supporting framework;

FIG. 10 is a front, elevational view of parts of the burster apparatus as shown in FIG. 8, and additionally shows part of the supporting framework;

FIG. 11 is a schematic block diagram illustrating the electrical interconnections of parts of the burster apparatus and transport mechanism; and

FIG. 12 is a view similar to FIG. 9, but shows a modified burster member.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIG. 1 of the drawing, the self-service, financial terminal **10** shown therein is intended to be free standing in the lobby of a bank and is arranged to provide printed statements on request to bank customers. The terminal **10** includes a housing **11** in an upper fascia portion **12** of which are provided a keyboard **14**, a form exit slot **16**, a card entry slot **18**, and a display screen **20**. In operation, a user inserts a customer identifying card into the slot **18** and then enters certain data such as his personal identification number upon the keyboard **14**. Instructions to the user for operating the terminal **10** are displayed on the screen **20**. In response to the data entered by the user, the terminal **10** prints account information on the leading portion of a continuous form **22** (FIG. 2) utilized in the terminal **10**.

The continuous form **22**, which has a width of 24 centimeters in the embodiment described, is separable into individual sheets (corresponding to successive portions **24** of the form **22**) by bursting the form **22** along transverse weakened lines **26** such as lines of perforations. The form **22** is provided with equidistantly-spaced, sprocket holes **28** adjacent each edge, by means of which the form **22** can be moved in the direction indicated by the arrow. Also, each portion **24** carries a mark **29** (hereinafter referred to as a stop mark) adjacent to its leading end, the purpose of which will be described later. In response to data entered by a user on

the keyboard 14, the terminal 10 prints account information on the leading portion 24 of the form 22, then separates this portion from the remainder of the form 22 by bursting the form 22 along the leading weakened line 26, and feeds the separated sheet to the user through the slot 16.

Referring now to FIG. 3, the continuous form 22 is fed from a storage container 30 by a pair of sprocket wheels 32 which engage the sprocket holes 28 of the form 22, the form being stored in fan-folded form in the container 30. Downstream of the sprocket wheels 32, the form 22 passes partly around a cylindrical platen 34 which, together with a print head schematically indicated at 36, forms part of the printing mechanism of the terminal 10. The continuous form 22 is held against the surface of the platen 34 by a guide roller 38. In the course of a bursting operation, the leading end of the form 22 is fed into one end of an elongated guideway 40 where it is gripped by the first pair 42' of a series of continuously rotating friction drive rollers 42. Between the platen 34 and the pair of guide rollers 42', the form 22 extends along a feed path 43 through a burster apparatus 44 made according to this invention. The burster apparatus 44 is arranged to separate the first portion 24 of the form 22 from the remainder of the form 22 by bursting the form along the leading, weakened line 26 in a manner to be described hereinafter. Each separated sheet 24' is fed along the guideway 40 by the drive rollers 42 to the exit slot 16 formed in the fascia portion 12 where the sheet 24' can be collected by the user of the terminal 10.

The burster apparatus 44 will now be described with reference to FIGS. 4 to 10. Although, as shown in FIG. 3, the form 22 passes through the burster apparatus 44 at a substantial angle to the horizontal, for ease of description, the apparatus 44 is illustrated in FIGS. 4 to 10 and described with reference thereto on the basis that it has an orientation such that the form 22 passes through the apparatus along a horizontal path.

The apparatus 44 includes a support frame 46 (FIG. 4) having parallel vertical side plates 48 and 50 and a transverse plate 52. A support rod 54 and front and rear guide members 55 and 56 extend between, and are secured to, the side plates 48 and 50. When the leading end of the form 22 is being fed forwardly inside the burster apparatus 44, said end is guided into and along the feed path 43 by an upper portion 57 (FIG. 5) of the guide member 56 and by an inclined portion 58 and an upper, horizontal portion 59 of the guide member 55, said end being eventually gripped by the first pair 42' of the friction drive rollers 42. The upper portion 59 of the guide member 55 supports the form 22 while it extends through the burster apparatus 44.

A shaft 60 (FIG. 4) is rotatably mounted in two bearings 62 which are secured to flanges 64 formed integrally with the transverse plate 52. The end portions of the shaft 60 pass through openings 66 (FIG. 5) formed in the side plates 48 and 50, and a pair of identical cams 68 and 70 are respectively secured to the ends of the shaft 60, the cams 68 and 70 being respectively positioned adjacent the outer faces of the side plates 48 and 50 (FIG. 4). A gear wheel 72 is mounted on the shaft 60. The gear wheel 72 engages a gear wheel 74 (FIG. 5) arranged to be driven by means of a clutch 76 and drive shaft 78 mounted on a support frame 80 (FIG. 3). The drive shaft 78 is continuously driven by the drive means 79 (shown schematically) which serve to drive the rollers 42. The arrangement of the clutch 76, drive shaft 78 and gear wheels 72 and 74 is such that operation of the clutch 76 brings about a single complete revolution of the shaft 60 and cams 68 and 70 in the direction indicated by the arrows in FIGS. 6 to 8.

A rigid metal burster rod 82 (best shown in FIG. 9), which has a straight axis and constant circular cross-section and which typically has a diameter of about 3 millimeters in the embodiment described, extends across the gap between the side plates 48 and 50, the end portions of the rod 82 passing through and being slidably mounted in two vertically extending slots 84 (FIG. 6), formed in the side plates 48 and 50, respectively. Each end of the rod 82 is slidably supported in a cylindrical recess 86 (FIG. 4) formed in a respective support member 88. The support members 88 are respectively mounted on two generally vertically extending link members 90 and 92 (FIG. 4) adjacent the lower ends thereof. The upper ends of the link members 90 and 92 are rotatably mounted, respectively, on two support studs 94 which are each mounted on a respective one of the cams 68 and 70. As is seen in FIGS. 7 and 8, the positions at which the studs 94 are attached to the cams 68 and 70 are angularly displaced from each other relative to the axis of the shaft 60. Due to this angular displacement, when the cams 68 and 70 are in their rest position as shown in FIGS. 4 and 5, the burster rod 82 is disposed at an angle to the horizontal with its left hand end (with respect to FIG. 4) higher than its right hand end. During a revolution of the cams 68 and 70, the burster rod 82 changes its angular disposition to the horizontal, the rod 82 first passing through a horizontal position to a position (as seen in FIGS. 9 and 10) in which its left hand end is lower than its right hand end, and then passing back through a horizontal position to the position shown in FIG. 4. It will be appreciated that such change in angular disposition is made possible by virtue of the fact that the ends of the burster rod 82 are slidably supported in the recesses 86 in the support members 88.

The burster apparatus 44 also includes a clamp member 96 which is vertically movable between an upper, non-clamping position as seen in FIGS. 4 and 5 and a lowermost clamping position as seen in FIG. 6. The clamp member 96 comprises side support portions 98, a front, lower horizontal portion 100, and a rear, inverted U-shaped portion 102 (FIG. 6) which is integral with the portion 100. The lower face of the horizontal portion 100 is provided with a layer 104 of elastomeric material, and the free end 105 (FIG. 6) of the U-shaped portion 102 is positioned in substantially the same horizontal plane as the lower face of the horizontal portion 100. When the clamp member 96 is in its clamping position, the form 22 is firmly clamped between the layer 104 and the upper horizontal portion 59 (FIG. 6) of the guide member 55. The portions 100 and 102 and the layer 104 extend across substantially the whole of the gap between the side plates 48 and 50. Each support portion 98 (FIGS. 4–6) is pivotally mounted on a stud 106 mounted on a respective cam arm 108, the cam arms 108 being respectively associated with the cams 68 and 70. Each cam arm 108 is pivotally mounted on a stud 110 secured to the adjacent one of the side plates 48 and 50, and each cam arm 108 carries a follower roller 112 which bears against the periphery of the associated cam 68 or 70, each follower roller 112 passing through a slot 114 (FIGS. 5 and 6) formed in the adjacent side plate 48 or 50. The follower rollers 112 are held in engagement with the cams 68 and 70 by means of respective tension

springs 116. One end of each spring 116 is connected to the support rod 54, the other end of the spring 116 being connected to the adjacent support portion 98 of the clamp member 96 by means of a stud 118 (FIG. 4). Each support portion 98 has secured thereto a guide stud 120 which is a sliding fit in a vertically extending portion 122 (FIG. 5) of the slot 114 formed in the adjacent side plate 48 or 50. During a revolution of the cams 68 and 70, the follower rollers 112 bring about a pivoting or rocking movement of the cam arms 108 about the studs 110. By virtue of the connection of the support portions 98 of the clamp member 96 to the cam arms 108 and by virtue of the sliding engagement of the guide studs 120 in the vertical slot portions 122, the rocking movement of the cam arms 108 brings about a movement of the clamp member 96 towards and away from the upper portion 59 (FIG. 5) of the guide member 55 in a direction substantially normal to said portion 59.

A vertically extending optical sensing device 124 (FIGS. 4 and 5) is secured to the transverse plate 52 adjacent the side plate 50. The lower, sensing end of the device 124 is positioned a short distance above the feed path 43 for the form 22, and, in operation, as the leading portion 24 of the form 22 passes through the burster apparatus 44, the device 124 is arranged to sense the stop mark 29 (FIG. 2) carried by the next succeeding portion 24.

Referring now to FIG. 11, the financial terminal includes electronic control means 126 connected to the clutch 76, to the optical sensing device 124, and to an electric motor 128 arranged to drive the sprocket wheels 32 and platen 34. In response to the sensing by the sensing device 124 of a stop mark 29 on the form 22, the control means 126 is arranged to stop the motor 128 and to operate the clutch 76 so as to bring about a single revolution of the cams 68 and 70.

The operation of the burster apparatus 44 and associated parts of the financial terminal will now be described. Immediately prior to a customer requesting a statement from the terminal 10, the burster apparatus 44 is in a rest (non-operated) condition as shown in FIGS. 4 and 5, and the sprocket wheels 32 and platen 34 are stationary. With the burster apparatus 44 in its rest condition, the leading edge of the form 22 is positioned in a plane containing the longitudinal axes of the slots 84, the burster rod 82 is positioned on that side of the feed path 43 remote from the clamp member 96, the clamp member 96 is in a non-clamping position furthermost from the guide member 55, and the cams 68 and 70 are stationary, with each follower roller 112 being held in engagement with a low portion 130 of the respective cam 68 or 70.

Upon a user initiating a statement printing operation by inserting his customer identifying card in the slot 18 and entering appropriate data upon the keyboard 14, the motor 128 is energized so as to cause the sprocket wheels 32 and platen 34 to drive the form 22 past the print head (FIG. 3), the print head 36 being arranged to print account information on the leading portion 24 of the form 22. As the form 22 is fed past the print head 36, the leading edge of the form 22 is guided by the guide members 55 and 56 into and along the feed path 43, this edge being eventually gripped by the continuously rotating drive rollers 42'. After the print head 36 has completed its printing operation, the leading portion 24 of the form 22 continues to be fed through the burster apparatus 44 until the sensing device 124 senses the stop mark 29 carried by the next succeeding portion 24 of the form 22. Thereupon, the sensing device 124 outputs a stop signal to the control means 126 which deenergizes the motor 128 so as to stop the movement of the form 22 along the feed path, the stationary sprocket wheels 32 acting as a brake on the form 22. The stop marks 29 on the form 22 are so positioned that the form 22 is stopped with the leading weakened line 26 positioned in the path of movement of the burster rod 82, that is to say immediately above the burster rod 82 with reference to FIGS. 5 and 6.

Immediately following the stopping of the form 22, the control means 126 applies an energizing signal to the clutch 76 so as to operate the clutch 76 and thereby bring about a single complete revolution of the cams 68 and 70. During a first part of the revolution of the cams 68 and 70, the follower rollers 112 move from the low portions 130 of the cams 68 and 70 on to high portions 132 thereof. The clamp member 96 is thereby caused to move from the non-clamping position shown in FIG. 5 to the clamping position shown in FIG. 6, the guide studs 120 sliding along the slot portions 122 in the side plates 48 and 50. With the clamp member 96 in its clamping position, the leading portion 24 of the form 22 is firmly gripped between the elastomeric layer 104 of the clamp member 96 and the portion 59 of the guide member 55. The leading portion 24 of the form 22 is gripped in a region adjacent the leading weakened line 26, and the end 105 of the clamp member 96 is positioned a short distance from the form 22 and adjacent the leading weakened line 26, the end 105 and the layer 104 being positioned on opposite sides of this line 26. By virtue of the clamping action of the clamp member 96 and the engagement of the form 22 by the stationary sprocket wheels 32, the portion of the form 22 extending between the clamp member 96 and the platen 34 is held in a taut condition.

During this first part of the revolution of the cams 68 and 70, the clamp member 96 is moved into its clamping position, and the burster rod 82 remains on that side of the feed path 43 remote from the clamp member 96, however, it changes from an orientation in which its left hand end is higher than its right hand end (with reference to FIG. 4) to an orientation in which its right hand end is higher than its left hand end (as shown in FIGS. 9 and 10). Referring now particularly to FIGS. 7 to 10, during a second part of the revolution of the cams 68 and 70 the form 22 remains clamped as described above and a bursting movement of the burster rod 82 is brought about by the link members 90 and 92. These link members 90 and 92 raise the rod 82 from the position shown in FIGS. 7 and 9 in which it is below the feed path 43 to the position shown in FIGS. 8 and 10 in which it is above the feed path; during this bursting movement, the burster rod 82 is inclined relative to the feed path 43, the right hand end of the rod (with reference to FIGS. 9 and 10) remaining higher than the left hand end. In the course of the bursting movement of the burster rod 82, the rod 82 first contacts the right hand end (with reference to FIGS. 9 and 10) of the leading weakened line 26 and then progressively bursts the form 22 along this line 26 from the right hand edge of the form 22 to its left hand edge. Thus, at the completion of this second part of the revolution of the cams 68 and 70, the leading portion 24 of the form 22 is completely separated from the remainder of the form 22 so as to form a separated sheet 24', as seen in FIG. 8. It should be understood that, during this bursting movement of the rod 82, the end 105 of the clamp member 96 serves

to prevent any substantial upward movement of the form 22.

During the remaining part of the revolution of the cams 68 and 70, the follower rollers 112 move back on to the low portions 130 of the cams 68 and 70, thereby causing the clamp member 96 to be returned under the action of the springs 116 to its non-clamping position shown in FIGS. 4 and 5. At the same time, the burster rod 82 returns to its rest position below the feed path 43, again as shown in FIGS. 4 and 5. Immediately after the clamp member 96 moves away from its clamping position, the separated sheet 24' is fed by the continuously rotating friction drive rollers 42 along the guideway 40 to the position shown in FIG. 3 where this sheet 24' is available for collection by the user of the financial terminal 10.

Referring now to FIG. 12, there is shown therein a modified burster rod 82'. The burster rod 82' is slidably supported at its ends in the recesses 86 in the support members 88 in the same manner as is the burster rod 82. The modified burster rod 82' has a straight axis but it differs from the rod 82 in that it has a non-uniform cross-section. Thus, the rod 82' includes end portions 130 having the same diameter as the rod 82, and a main portion 132 of wider diameter, typically 6 millimeters, which tapers at one end (the right hand end with reference to FIG. 12) to a bevelled portion 134. The bevelled portion 134 adjoins the right hand end portion 130 and has a maximum diameter substantially equal to the diameter of the main portion 132.

During a bursting movement of the rod 82', the first part of the rod 82' to contact the form 22 is the bevelled portion 134. The portion 134 contacts the leading weakened line 26 at a location, indicated by the reference "X" in FIG. 12, which location is about 1.5 centimeters from the right hand edge (with reference to FIG. 12) of the form 22. Bursting of the form 22 commences at this location, and thereafter, the rod 82' progressively bursts the form 22 from this location towards both edges of the form 22 until a complete separation of the leading portion 24 of the form 22 has been effected. It is found that the use of the modified rod 82' is particularly advantageous in achieving satisfactory bursting of a continuous form in the case where the weakened lines are formed by lines of perforations in which there is a substantial distance from each edge of the form to the first perforation from that edge.

In a further modification of the burster apparatus 44 described above, the burster rod 82 could be replaced by a wire arranged to be stretched tautly between the link members 90 and 92 during a bursting movement of the wire through the feed path 43.

The burster apparatus 44 described above with reference to the accompanying drawing effects a reliable and correct bursting of the continuous form 22 along the leading weakened line 26, and it is found that effective bursting is achievable even in the event of this line being improperly formed. Moreover, this burster apparatus has the additional advantages that it is of low cost and has a compact form of construction.

What is claimed is:

1. A burster apparatus for separating into sheets a web which has transverse weakened lines formed thereon, comprising:

conveying means for conveying said web along a feed path through said apparatus;

an elongated burster member extending across said feed path and having first and second ends;

mounting means for mounting said first and second ends of said elongated burster member for movement in a plane which is substantially perpendicular to said feed path at a predetermined position in said feed path;

clamping means for clamping said web with one of said weakened lines being held in said predetermined position;

moving means for moving said clamping means between clamping and non-clamping positions; and

actuating means for individually moving said first and second ends of said elongated burster member in said plane so as to move said elongated burster member at an angle to said feed path to progressively burst said web at said weakened line at said predetermined position when said clamping means is in said clamping position;

said conveying means being effective to move a separated sheet from said web after said clamping means is moved to said non-clamping position.

2. The burster apparatus as claimed in claim 1 in which said elongated burster member comprises a rigid rod.

3. The burster apparatus as claimed in claim 2 in which said rigid rod has an axis.

4. The buster apparatus as claimed in claim 2 in which said elongated burster member has a configuration which enables a portion of said elongated burster member to contact said web at a location between the center of said web and one edge thereof.

5. The burster apparatus as claimed in 2 in which said actuating means includes cam means including first and second cams to progressively burst said web, said cam means also including first and second links coupled respectively between said first and second ends of said burster member and said first and second cams to move said elongated burster member at said angle as said cam means is rotated.

6. The burster apparatus as claimed in claim 5 in which said actuating means includes means for coupling said moving means with said cam means so as to move said clamping means between said clamping and non-clamping positions in response to the rotation of said cam means.

7. The burster apparatus as claimed in claim 6 in which said web has a plurality of stop marks thereon for use in aligning a said transverse weakened line at said predetermined position, and in which said conveying means includes a sensing means which is positioned in said burster apparatus for producing an output upon sensing a said stop mark, said output being used by said conveying means to align a said transverse weakened line at said predetermined position.

8. The burster apparatus as claimed in claim 7 in which said actuating means includes a clutch means for rotating said cam means through one revolution to progressively burst said web in response to said output from said sensing means.

9. The burster apparatus as claimed in claim 8 in which said clamping means includes a clamp which is positioned adjacent to and upstream from a said weakened line when said clamping means is in said clamping position.

10. The burster apparatus as claimed in claim 9 in which said clamp has a face with elastomeric material thereon to engage said web when said clamping means is in said clamping position.

* * * * *

Exhibit Z

United States Patent [19]

Kadlecik et al.

[11] **4,401,249**

[45] **Aug. 30, 1983**

[54] **AUTOMATIC BURSTER APPARATUS HAVING A DOUBLE BURSTING BAR**

[75] Inventors: **Jack Kadlecik**, Macedon; **Alvin M. Hill**, Rochester, both of N.Y.

[73] Assignee: **Burroughs Corporation**, Detroit, Mich.

[21] Appl. No.: **335,421**

[22] Filed: **Dec. 29, 1981**

[51] **Int. Cl.**³ **B65H 35/10**

[52] **U.S. Cl.** **225/97**; 225/100

[58] **Field of Search** 225/100, 97, 98, 4; 270/52.5

[56] **References Cited**

U.S. PATENT DOCUMENTS

3,338,487	8/1967	Schutz	225/100
3,667,663	6/1972	Kacmarcik et al.	225/100
3,991,924	11/1976	Schueler	225/100
4,118,022	10/1978	Rayfield et al.	270/52.5
4,269,341	5/1981	Polko	225/100 X

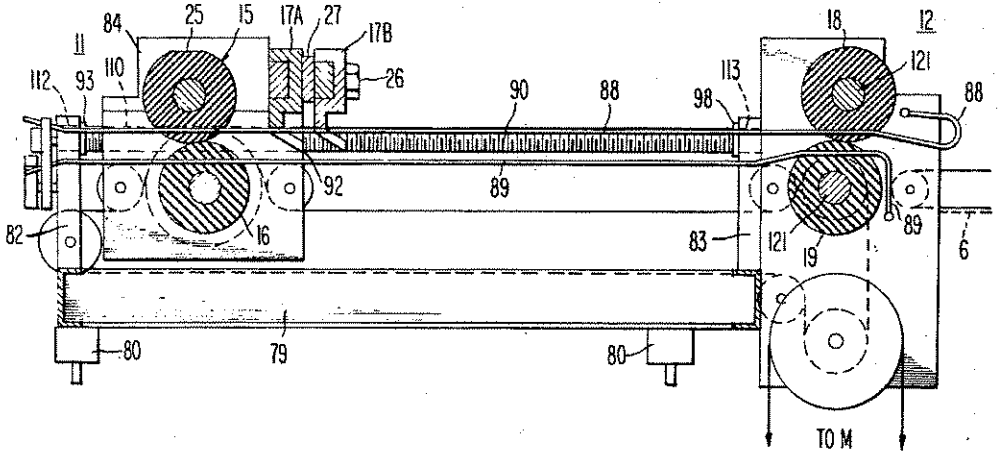
Primary Examiner—Frank T. Yost

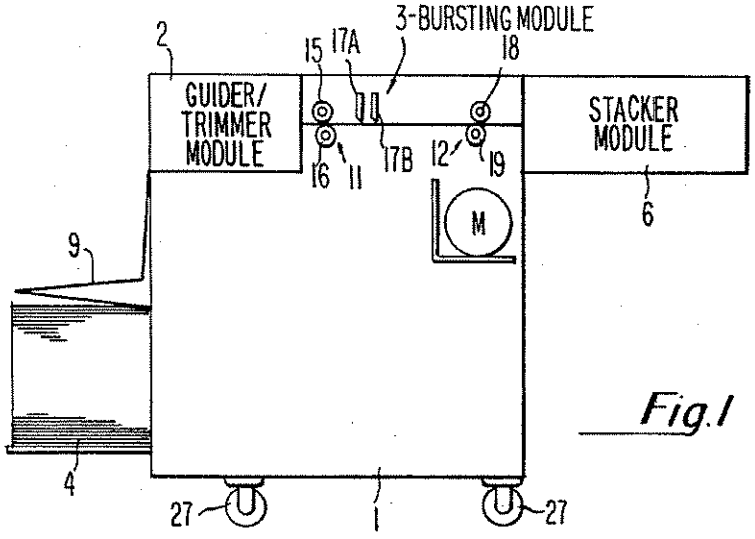
Attorney, Agent, or Firm—David G. Rasmussen; Kevin R. Peterson; Edmund M. Chung

[57] **ABSTRACT**

An apparatus for automatic bursting of perforated continuous forms is disclosed. The apparatus comprises first and second feeder means which may comprise two pairs of rotating rollers with tensioning means being provided by rotating the roller pairs at a slight speed differential. The apparatus also includes releasing means for intermittently releasing the feeding action of the first feeder means or roller pair. The releasing means may be provided by a flat area on the surface of one of the low speed rollers for releasing the nip in the low speed rollers to allow the forms to slip and uncrinkle. The apparatus also includes first and second forms separation means which cooperate with perforations in the forms to separate the forms, the first separation means acting when no immediately preceding forms slippage has occurred and the second separation means acting when immediately preceding forms slippage has occurred. The first and second separation means may comprise, respectively, a first burster blade and a second burster blade spaced a small distance downstream from the first burster blade.

11 Claims, 6 Drawing Figures

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17A
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GUIDER/
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MODULE
STACKER
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Fig.1

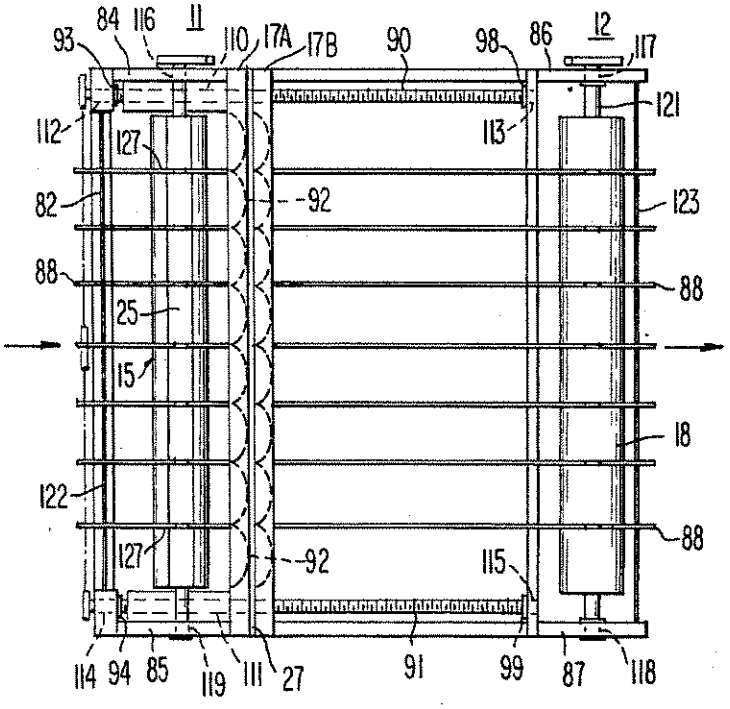
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Fig.5

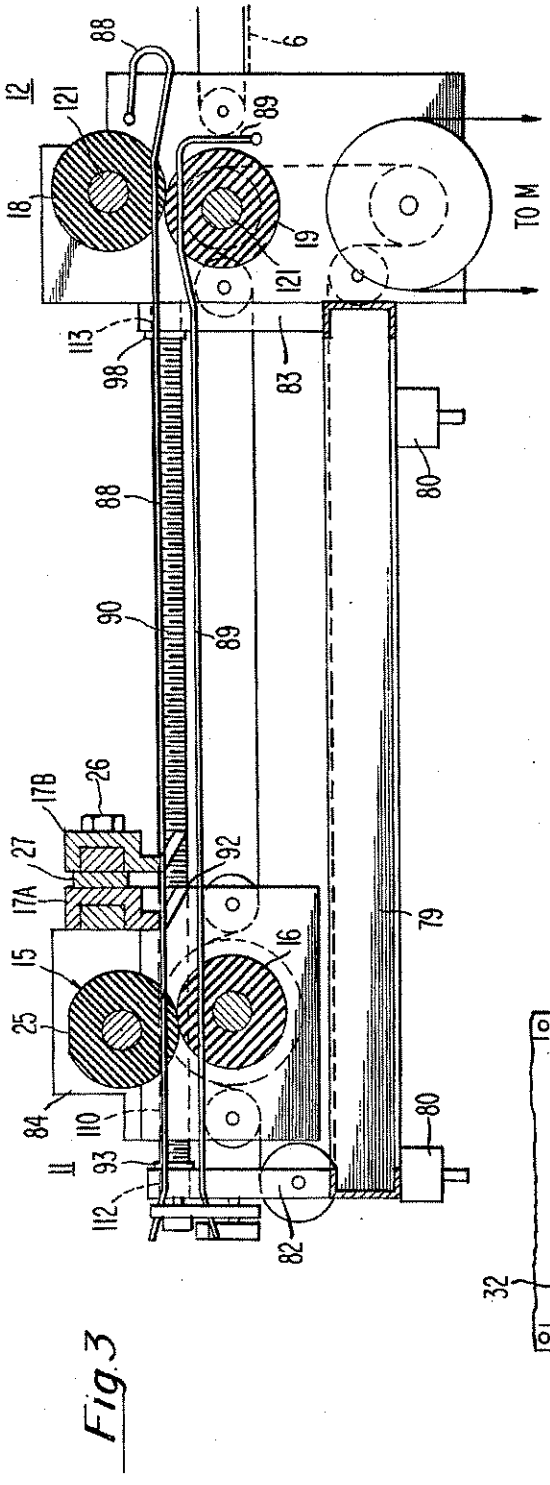

Fig. 3

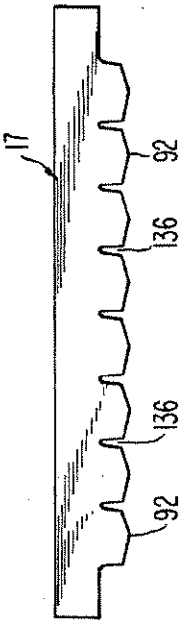

Fig. 6

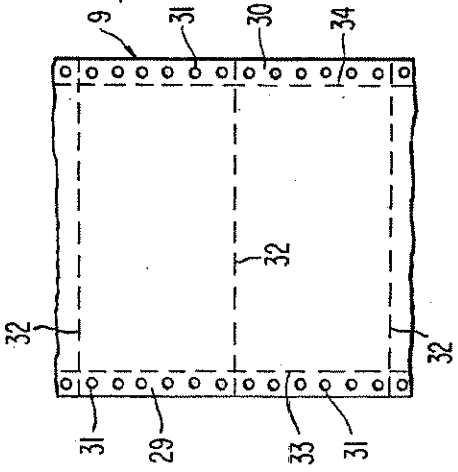

Fig. 2

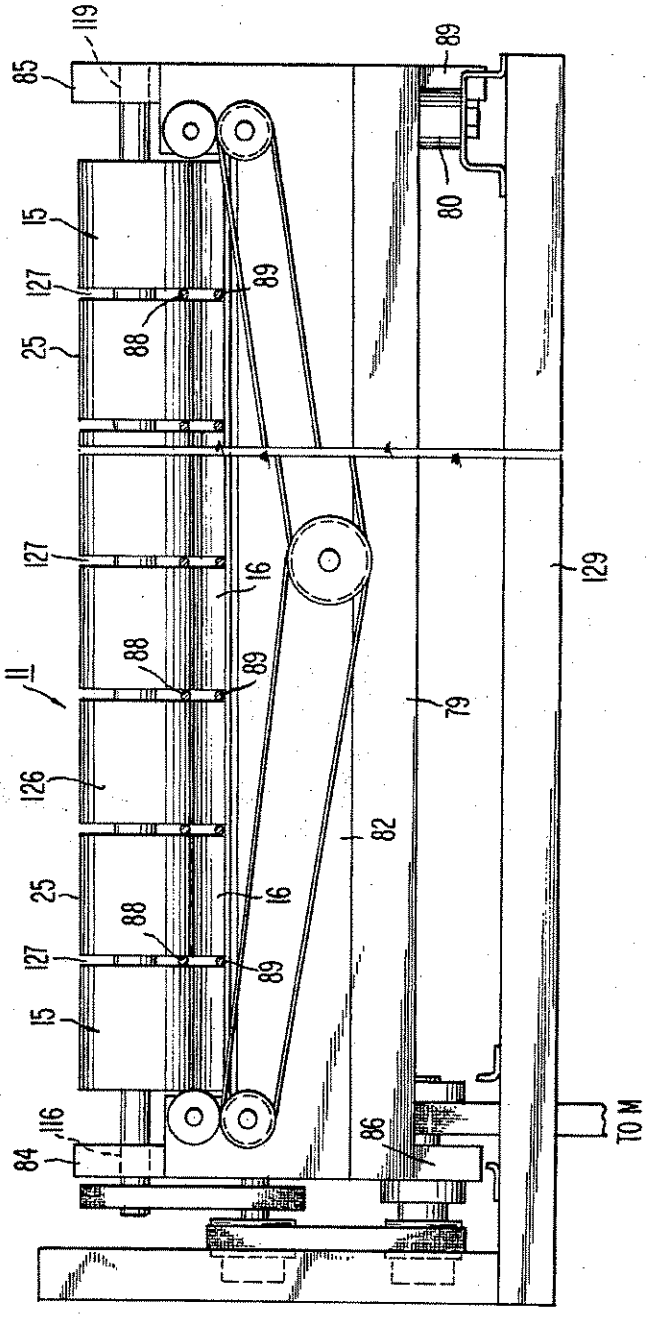
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Fig. 4

AUTOMATIC BURSTER APPARATUS HAVING A DOUBLE BURSTING BAR

BACKGROUND OF THE INVENTION

The invention relates to the field of automatic bursting of perforated continuous forms. More particularly, the invention relates to an improvement of an apparatus for bursting forms which includes means for achieving forms uncrinkling through allowing forms slippage and means for accomplishing forms separation in the event of forms slippage.

In well known prior art bursting apparatus, a pair of high speed rollers and a pair of low speed rollers coact with a bursting blade to achieve separation along the preweakened zones of continuous paper forms. In such devices the continuous forms would be drawn between the upper and lower low speed rollers as they rotated. The forms could then be propelled beneath the burster bar and thence to the rotating upper and lower high speed rollers. At this point the speed differential between the high speed and low speed rollers would cause the forms to be tightly stretched. The placement of the bursting bar would be set to cause the preweakened zone of the continuous forms to arrive at a point directly beneath the bursting area of the bursting bar at the moment of maximum forms stretch. The perforation of the forms would be pushed tauntly against the bursting area of the bursting bar, thus initiating a line of separation along the perforations of the continuous forms. When separation would be completed, the high speed rollers would cause the separated form to be ejected toward a stacking means. The continuous forms would then be propelled to the upper and lower high speed rollers for bursting along the next line of perforation.

An improvement disclosed in U.S. Pat. No. 4,118,022 is to provide two pairs of flat areas formed into the bearing surface of the upper roller of the low speed roller pair which first receives the forms. The flat areas improve the reliability of the forms feeding process by enabling removal of crinkles which frequently occur in the forms as they pass through the rollers. When a flat area on the upper roller faces the lower roller, the nip for gripping and feeding the forms defined by the mating upper and lower rollers is released, allowing the forms to slip and remove crinkles. In practice, however, it has been found that a disadvantage of having such flat areas is that when the forms slip, the preweakened zones slip past the burster bar such that the perforated zone is no longer at the right position with respect to the bursting bar for separation to occur. This results in jamming of the bursting apparatus and the necessity of stopping the system and unjamming it by hand.

SUMMARY OF THE INVENTION

It is therefore, an object of the invention to provide a bursting apparatus having an improved bursting blade which can accomplish bursting of continuous forms when slippage occurs due to uncrinkling of the forms at a flatted roller.

It is another object to provide bursting apparatus which minimizes jamming of the forms in the roller pairs.

It is yet another object of the invention to provide bursting apparatus which accomplished more consistent bursting of continuous forms.

These, and other objects of the invention, are achieved by providing a bursting apparatus having a first feeder means for advancing continuous forms from a supply tray, second feeder means for receiving said continuous forms from said supply tray and advancing the burst forms to a stacking device, tensioning means for tensioning the forms between the first and second feeder means, releasing means for intermittently releasing the feeding action of the first feeder means such that crinkles in said continuous forms may be removed, first forms separating means disposed at a point between first and second feeder means for cooperating with preweakened zones in said continuous forms to burst said forms when no uncrinkling of said continuous forms has occurred immediately prior to said bursting, and second forms separating means disposed at a point between said first and second feeder means for cooperating with preweakened zones in said continuous forms to burst said forms when uncrinkling of said continuous forms has occurred immediately prior to said bursting.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an idealized side view of the bursting apparatus of the present invention showing the relationship of the novel bursting unit of the instant invention to the guide/trimmer module and the stacker module of a typical bursting apparatus.

FIG. **2** shows an example of a typical sprocketed continuous form which may be burst by the apparatus of the instant invention.

FIG. **3** is a detailed side view of the bursting apparatus of the present invention.

FIG. **4** is a top view of the bursting apparatus shown in FIG. **3**.

FIG. **5** is a view of the left end of the bursting apparatus shown in FIG. **3**.

FIG. **6** shows a preferred form of bursting blade adapted for use in the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. **1** of the drawings, there is shown an idealized side view of a continuous forms bursting apparatus having a frame and cabinet **1**, resting on coasters **27**, generally four in number. From the stacking tray **4**, continuous forms **9** would enter the guider/-trimmer module **2**, shown in block diagram form, and pass to the bursting module shown generally at **3**. The continuous forms **9** pass through the first feeder means **11** which preferably comprises vertically tilted linearly adjustable low speed rollers denoted at **15** and **16**. The forms pass under first and second separating means **13** and **14** which preferably comprises bursting blades **17A** and **17B** respectively and then enter into the second feeder means **12** which preferably comprises vertically tilted fixed high speed rollers denoted at **18** and **19**. Tensioning means are provided through the above-described vertical tilting of the roller pairs **15**, **16**, and **18**, **19** and through the speed differential between the low speed rollers **15** and **16** and the high speed rollers **18** and **19**. This arrangement causes stresses to be built up along the preweakened zones of the continuous forms **9**. The spacing between the high speed and low speed units is normally adjusted so these preweakened zones occur directly below the first blade **17A**. The high speed and low speed rollers are driven by a series of belts and pulleys (not shown) by motor M. Burst forms are ejected into stacker module **6**. An example of a

loading tray, guide/trim module, decollator unit to separate a carbon and one or more copies, and a stacker module which are compatible with the instant disclosed invention are contained in U.S. Pat. No. 4,118,022.

An example of a typical continuous form, as might be used in the invention, is shown in FIG. 2. Continuous form 9 has a plurality of printing areas bounded by left and right hand margins 29 and 30, respectively, and a plurality of interform perforations of preweakened areas 32. Both left and right hand margins 29 and 30 may also be provided with marginal perforations 33 and 34 parallel to their respective left and right edges. Additionally, the forms may be provided with a plurality of equispaced sprocket holes 31 which are adapted to engage the well known tractor pin drives used in prior art bursters and data processing equipment. It will be noted, however, that the present invention does not require the presence of sprocket holes 31 on forms to be burst since the present invention may be used with guiding and feeding means adapted to handle both sprocketed and unsprocketed continuous forms as discussed in U.S. Pat. No. 4,118,022.

With reference to FIGS. 3, 4, and 5, there are shown more detailed views of the bursting module of the instant invention. Base 79 rests on four cushioned mounts 80, which in turn are mounted on a rigid base 129, as shown generally in FIG. 5. Vertical supports 82 and 83 are mounted at opposite ends of base 79 and are mechanically joined by left and right threaded rods 90 and 91, respectively. Left side threaded rod 90 is rotatably joined at one end to thrust bearing 93 disposed at opening 112 of support 82, and at its other end to thrust bearing 98 disposed in opening 113 of support 83. Likewise, right side threaded rod 91 is rotatably joined at one end to thrust bearing 94 disposed in opening 114 of support 82, and at its other end to thrust bearing 99 disposed in opening 115 of support 83.

High speed rollers 18 and 19 are rotatably supported at the ends of their shafts 121 by openings 117 and 118 disposed in left and right fixed support blades 86 and 87, respectively. Left and right support plates 86 and 87 are mounted to opposite ends of support 83 and base 79 in a facing, spaced relationship.

Low speed rollers 15 and 16 are rotatably supported by openings 116 and 119 disposed in left and right movable carriage plates 84 and 85, respectively. Upper low speed roller 15 has a flat area 25 which runs substantially the entire length of roller 15. Left side carriage plate 84 has a threaded opening 110 which is adapted to engage the threads of left side threaded rod 90. Similarly, right hand side carriage plate 85 has a threaded opening 111 which is adapted to engage the threads of right side threaded rod 91. Threaded rods 90 and 91 may be of various diameters and threads per inch. The only requirement is that the threaded rods be of sufficient cross section to withstand the pressure placed parallel to their axis during the bursting of forms.

Burster blade 17A, shown in more detail in FIG. 6, is fixedly mounted on carriage supports 84 and 85 on the exit side of the low speed rollers 5 and 16. Burster blade 17B, which is identical to burster blade 17A shown in FIG. 6, is mounted onto carriage plate 84 and 85 with two bolts 26 which go through spacer 27 and blade 17A to carriage plates 84 and 85. By varying the width of spacer 27, the spacing between blades 17A and 17B may be adjusted. Preferably, bursting blades 17A and 17B comprise a strip of hard, inpact-resistant material having a plurality of arcuate bursting surfaces 92 disposed on the lower edges of bursting blades 17A and 17B, with each arcuate bursting surface being separated from its neighbor by guide slots 136. Burster blades 17A and 17B may be fashioned from strip steel, aluminum, high-impact molded plastic, or the like. Of course, it is not necessary that bursting surfaces 93 be arcuate in shape for the bursting apparatus to function properly; however, it has been found the providing a bursting blade with a plurality of arcuately shaped bursting areas improves the overall reliability of the bursting process.

The type of bursting bar described above may be replaced by many other types of bursting bars without departing from the scope of the instant invention. For example, a burst bar comprising a shaft supporting two or more spherical plastic balls approximately one inch in diameter, as well as a flat edged blade design, may be used.

Referring back to FIG. 3, it can be seen that both the low speed rollers 15 and 16, and the high speed rollers 18 and 19, are mounted such that their shaft axes are disposed at a slight angle from the vertical. Preferably, this angle is approximately 8°, though it could range from 0° up to about 30°. This slight tilt in the axis of both the high and low speed rollers facilitates the guiding and improves the bursting action of the forms. Because of the tilt of the rollers, a form which is engaged between the low speed rollers 15 and 16 and the high speed rollers 18 and 19, would tend to be stretched slightly more across this upward surface than along its lower surface. This differential in upper and lower surface stretching of the form will tend to cause the form to begin separation along its perforations on the upward surface of the form thus concentrating the stretching forces along a very narrow portion of the form, as aided by the preferred brusting blade mentioned above. Rollers which are shown merely vertically mounted will tend to concentrate the stretching effect throughout the entire thickness of the form, resulting in higher bursting forces being necessary, greater noise, and less reliable bursting action.

The bearing surfaces 126 of rollers 15, 16, 18, and 19 are preferably composed of a hard, slightly compressable material having a good coefficient of friction. One such material, by way of example only, is neoprene rubber. Alternatively, the above mentioned rollers could be comprised solely of cold rolled steel, aluminum, or other hard materials if the bearing surfaces were appropriately roughened or scored to increase the grooving power.

As shown in FIG. 3, the first feeder means 11 is provided with releasing means shown generally at 24 which preferably comprises an upper low speed roller 15 with a flat area 25 formed into bearing surface 126 to help improve the reliability of the forms feeding process. The function of flat area 25 is to periodically release the nip in the low speed roller pair 15 and 16 to allow any crinkles which may have developed in the forms to be removed. The crinkles will be eliminated because the tension in the forms which exists due to the speed differential between the high speed rollers 18 and 19 and the low speed rollers 15 and 16 will cause the forms to snap and slip forward when the low speed roller nip is released. Alternatively, other arrangements of flat areas on the low speed roller pair could serve the function of allowing uncrinkling of the forms, for example as disclosed in U.S. Pat. No. 4,118,022.

Annular grooves 127 and burster blades slot 136 are adapted to receive in a noncontacting arrangement

upper wire form guides **88** and lower wire form guides **89** as shown in FIGS. **4** and **5**. Wire form guides **88** and **89** define an area between the upper low speed and high speed rollers and the lower low speed and high speed rollers through which the continuous forms may travel. Both upper and lower wire forms **88** and **89** are similar in construction. Each guide is comprised of a plurality of parallelly disposed stiff metal wires held in a spaced apart relationship by perpendicular tie wires **122** and **123** at the respective low speed and high speed ends. Of course it is not necessary that upper and lower wire form guides **88** and **89** be comprised of stiff metal wires, but could take the form of parallel metal strips or be composed of a plastic type material, rather than metal. Perpendicular tie wires **122** and **123** of upper and lower guides **88** and **89** are used to mount wire form guides **88** and **89** in a facing, spaced apart relationship in the low speed guides support **82** and high speed support **86** and **87**. The upper and lower wire form guides are arranged such that the plurality of parallelly disposed wires are disposed parallel to the direction of travel of the continuous forms and that the plane of the upper and lower wire form guides is substantially parallel to the plane of the path of the continuous forms in a bursting module.

As is shown in FIG. **3**, the low speed opening of wire forms **88** and **89** are spread apart slightly to more readily receive the entering continuous forms. A continuous form would be drawn between the upper and lower low speed rollers **15** and **16** as they rotated. The form would then be propelled beneath bursting blades **17A** and **17B**, each blade having a plurality of bursting areas **92** disposed thereon, and then to the rotating upper and lower high speed rollers **18** and **19**. At this point, the speed differential between the high speed and low speed rollers would cause the forms to be tightly stretched. The bursting module may be adjusted as described below to cause the preweakened areas of perforations **32** of continuous forms **9**, such as shown in FIG. **2**, to arrive at a point directly beneath the bursting areas **92** of the first bar **17A** of double bursting bar **17** at the moment of maximum stretch. The action of the oppositely tilted low and high speed rollers in conjunction with the path of the forms defined by upper and lower wire form guides **88** and **89** causes the perforation **32** of the forms to bear upward against the bursting areas **92** of bursting bar **17A**, thus initiating a line of separation along perforations **32** of the continuous forms **9**. When separation is complete, tilted high speed rollers **18** and **19** will cause the separated form to be ejected towards the stacking module shown only partially in FIG. **3**. The upper and lower wire form guides **88** and **89** are shaped in a slight downward curve at the high speed end to help direct the burst forms downward towards the stacking means **6**.

In operation, the distance between movable low speed rollers **15** and **16** and fixed high speed rollers **18** and **19** could be adjusted so as to place the arcuate bursting areas **19** and **22** of blade **17A**, which, as described above, is attached to the low speed roller unit, directly over a preweakened zone of perforation disposed on a set of continuous forms fed into the bursting module. That is, the placement of bursting blade **17A** would be set such that blade **17A** could be directly over a perforation in instances where no uncrinkling and therefore no slippage of the continuous forms had occurred during the time immediately preceding the perforations nearing the burst blades. At the same time, the placement of blade **17B** would be set such that blade **17B** would be in a position to accomplish forms separation in cases where form slippage had immediately preceded the desired bursting action. The spacing between blades **17A** and **17B** would be determined by the width of spacer **27**. Optimally, the second blade **17B** would be spaced a distance apart from blade **17A** whereby blade **17B** would be directly over the line at which maximum forms slippage would carry the line of perforation. Appropriate scale or indicia means could be placed near or adjacent the arcuate bursting area **92** of the first bar of the double burster bar to allow an operator to more easily adjust the distance between the movable low speed roller and the bursting bars and the fixed high speed roller for different sized forms.

What is claimed is:

1. Bursting apparatus for continuous forms comprising:

first feeder means for advancing said continuous forms from a supply tray;

second feeder means for receiving said continuous forms from said first feeder means and advancing the burst forms to a stacking device;

tensioning means for tensioning said forms between said first and second feeder means;

releasing means for intermittently releasing the feeding action of said first feeder means such that crinkles in said continuous forms may be removed;

first separating means disposed at a point between said first and second feeder means for cooperating with preweakened zones in said continuous forms to burst said forms when no uncrinkling of said continuous forms has occurred immediately prior to said bursting; and,

second separating means disposed at a point between said first and second feeder means for cooperating with preweakened zones in said continuous forms to burst said forms when uncrinkling of said continuous forms has occurred immediately prior to said bursting.

2. Bursting apparatus for continuous forms comprising:

a first pair of rotating rollers disposed to define a nip for advancing said continuous forms, at least one roller of said first pair having a flat area on a portion of its surface for releasing said nip to allow uncrinkling of said forms;

a second pair of rotating rollers disposed to define a nip for receiving said continuous forms from said first roller pair and for advancing said forms;

tensioning means for tensioning said forms between said first and second pairs of rollers;

first forms separating means disposed at a point between said first and second roller pairs for cooperating with preweakened zones in said continuous forms to burst said forms when no uncrinkling of said continuous forms has occurred immediately prior to said cooperation; and,

second forms separating means disposed at a point between said first and second roller pins for cooperating with preweakened zones in said continuous forms to burst said forms when uncrinkling of said nip has occurred immediately prior to said cooperation.

3. Apparatus according to claim **2** wherein said first and second froms separating means respectively comprises a first burster blade and a second burster.

4. Apparatus according to claim **3** wherein said first and second burster blades are disposed substantially

parallel to one another and substantially perpendicular to the direction of travel of said continuous forms.

5. Apparatus according to claim 4 wherein said substantially parallel first and second burster blades are adjustably spaced a small distance apart.

6. Apparatus according to claim 2 wherein said tensioning means comprises said first and second pairs of rollers disposed such that a plane passing through the axis of one of said pairs of rollers is angularly tilted from the vertical in an opposite rotational sense from a plane passing through the axis of the other said pair of rollers such that each said pair of rollers has a nip plane tangent to each roller but skewed with respect to the plane of travel of said forms between said first and second pairs of rollers, said second pair of rotating rollers being rotated at a higher speed than said first pair of rotating rollers.

7. Apparatus according to claim 6 wherein each roller in said first and second roller pairs is substantially tubular-shaped and the rollers in both said first and second roller pairs are disposed in a substantially contacting, facing relationship along said nip plane.

8. Apparatus according to claim 7 wherein said first and second roller pairs define a substantially horizontal path for said continuous forms.

9. Apparatus according to claim 8 wherein both said first and second roller pairs comprise an upper roller and a lower roller.

10. Apparatus according to claim 9 wherein said roller of said first pair of rotating rollers which includes said flat area is said upper roller.

11. In a bursting apparatus for continuous forms having a first pair of rotating rollers disposed to define a nip for advancing said continuous forms, at least one of said first pair having a flat area on a portion of its surface for releasing said nip to allow uncrinkling of the forms, a second pair of rotating rollers disposed to define a nip for receiving said continuous forms from said first roller pair and for advancing said forms, tensioning means for tensioning said forms between said first and second pairs of rollers, the improvement comprising first forms separation means disposed at a point between said first and second roller pairs for cooperating with preweakened zones in said continuous forms to burst said forms when no releasing of said nip has occurred immediately prior to said cooperation and second forms separation means disposed at a point between said first and second roller pairs for cooperating with preweakened zones in said continuous forms to burst said forms when releasing of said nip has occurred immediately prior to said cooperation.

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